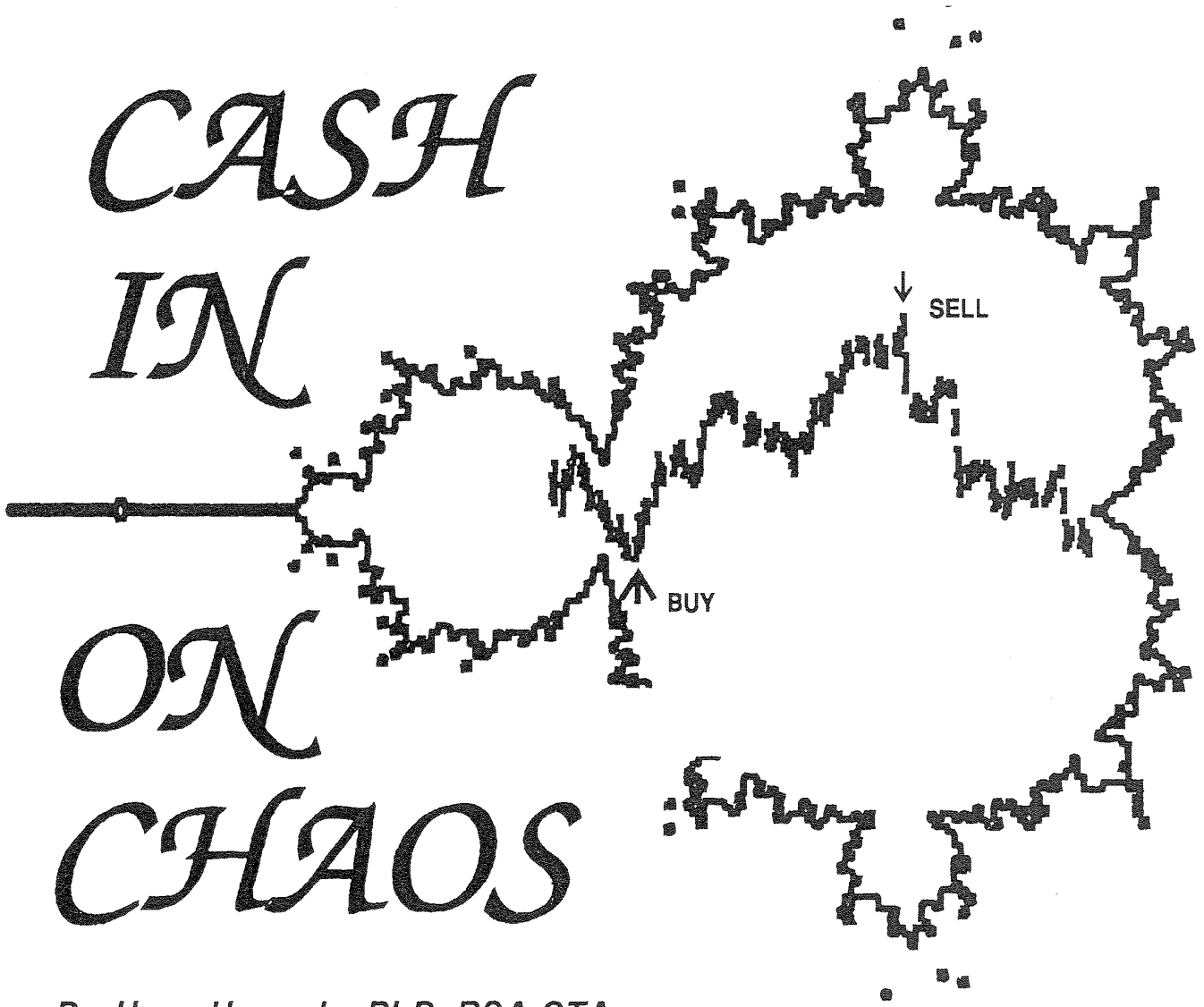
CASH IN ON CHAOS



Dr. Hans Hannula, PhD, RSA,CTA

MY INFORMATION CLASSIFICATIONS

1. **PUBLIC**
   Chaos Clamshell, 7 moves, Pearl of Wisdom

2. **CONFIDENTIAL**
   Cash In On Chaos Course

3. **SECRET**
   MAP Masters Course-Part 1

4. **TOP SECRET**
   MAP Masters Course-Part 2

5. **CRYPTO SECRET**
   equations, engineering simulation, neural nets

coverd by state, federal, and international trade secrecy laws

What you get today is sufficient for successful use in real world trading.

GOALS

1. **DE-MYSTIFY CHAOS**
2. **OVERCOME JARGON BARRIERS**
3. **DE-MYSTIFY MARKETS**
4. **GIVE YOU A TRADING EDGE**

Make everything as simple as possible, but no simpler.

-Dr. Albert Einstein

CASH IN ON CHAOS

1. What Chaos is
   - -system concept
   - -linear systems
   - -non-linear sytems

2. Behavior of Non-linear Systems
   - -state space
   - -strange attractors
   - -strange repellors
   - -tests for data series

3. Limit Cycles
   - -linear and nonlinear
   - -finding on charts

4. Frequency shifts
   - -frequency doubling
   - -fibrilation
   - -tracking with Zero Delay filter

CASH IN ON CHAOS

5. Fractal Dimension
    - -Mandelbrot's Fractal Geometry
    - -Fractal Dimensions of Coastlines
    - -Polarized Fractal Efficiency

6. Fractal Patterns
    - -Iterated Function Sequneces
        - -algebraic
        - -geometric

7. The Hannula Market Fractal
    - -Basic Shape
    - -Variations
    - -Structure
    - -Measures
    - -Projections

CASH IN ON CHAOS

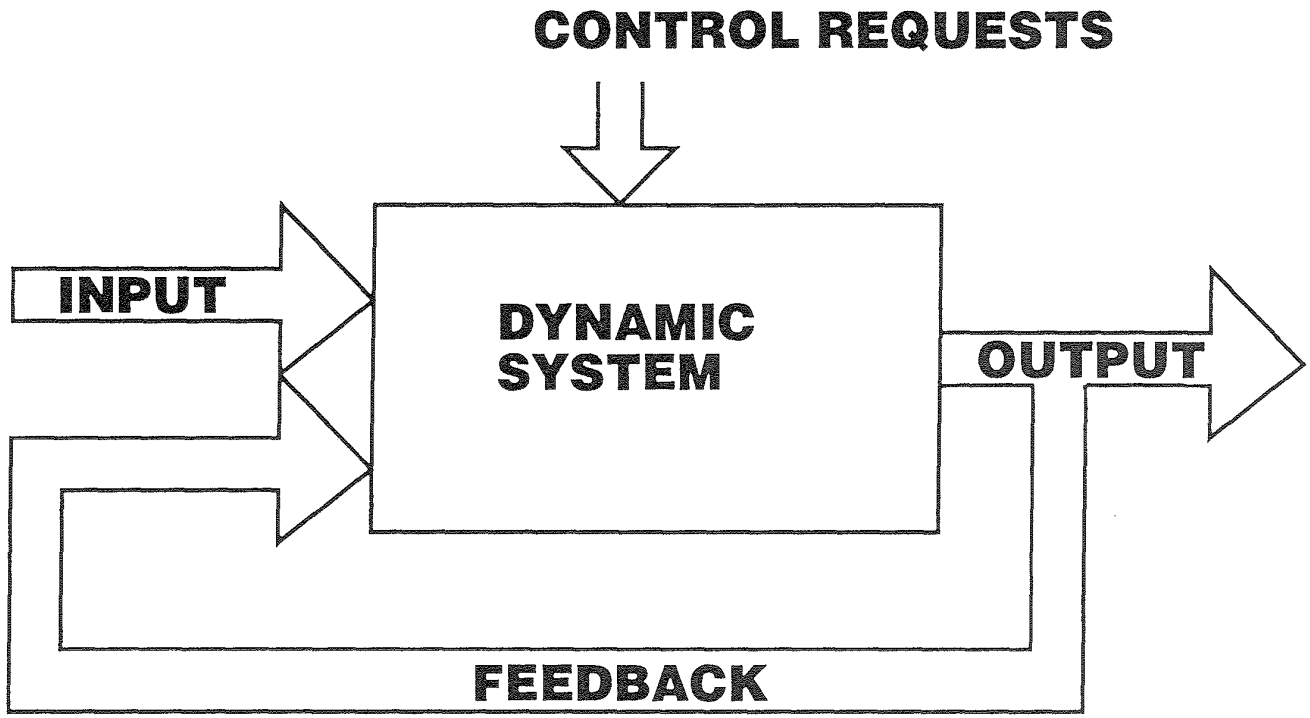
8. Trading Examples
   - -Entry Points
   - -Exit Points
   - -Hannula Hook
   - -SAR

9. Sources of Market Chaos
   - -Market AstroPhysics
   - -Sources of nonlinearity
   - -Examples
   - -Lunar Chaos Theory

10. Conclusion
    - -Summary
    - -Software Demo
    - -Reading references

What is chaos?

CHAOS IS A SYSTEMS CONCEPT

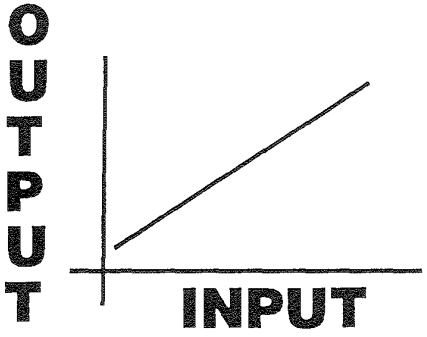


SYSTEM EXAMPLES

SYSTEM	INPUT	SYSTEM COMPONENTS	OUTPUT
AUTO SUSPENSION		SPRINGS,SHOCKS, TIRES, AXLE	
CAMERA			
HEART			
STOCK MARKET		floor broker, computerized	price
PLANETS			

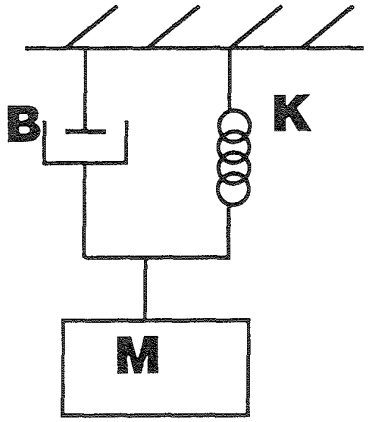
KNOWLEDGE OF SYSTEM CONSTRUCTION PERMITS MATHEMATICAL CALCULATIONS OF BEHAVIOR.

A LINEAR SYSTEM IS ONE IN WHICH THE OUTPUT IS DIRECTLY PROPORTIONAL TO THE INPUT



proportioneel

MODEL



MATHEMATICS

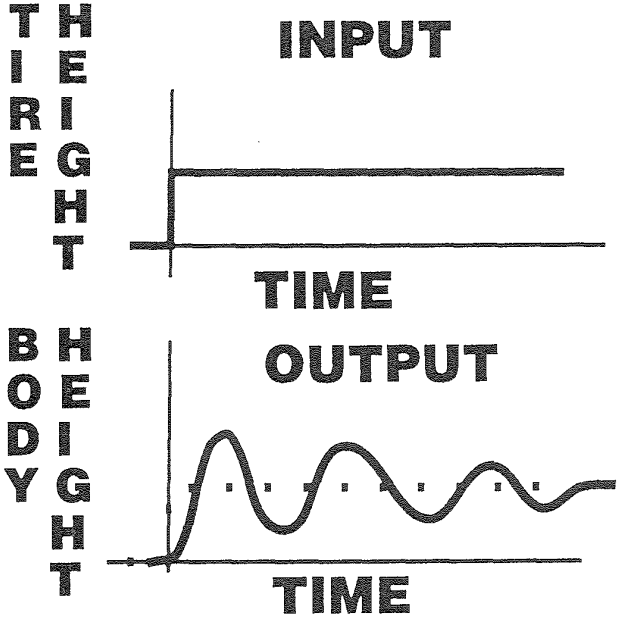
kracht

$$f(t)=m\ddot{x}+b\dot{x}+kx$$

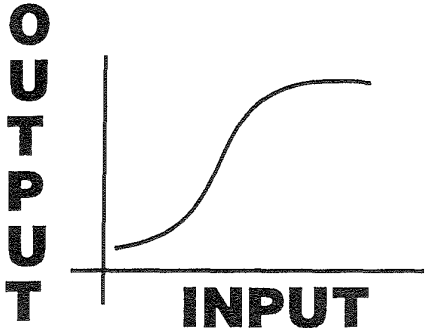
m,b,k constant

This is a linear differential equation, easily solved

BEHAVIOR

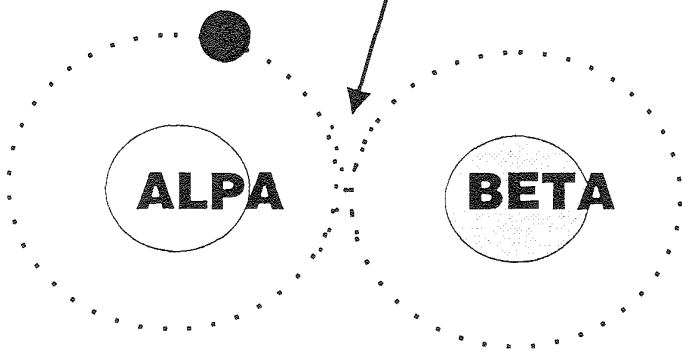


A NONLINEAR SYSTEM IS ONE IN WHICH THE OUTPUT IS NOT DIRECTLY PROPORTIONAL TO THE INPUT



MODEL **MATHEMATICS** **BEHAVIOR**

bifurcation



SATELLITE BETWEEN TWO PLANETS

Sum of Forces on satellite=0

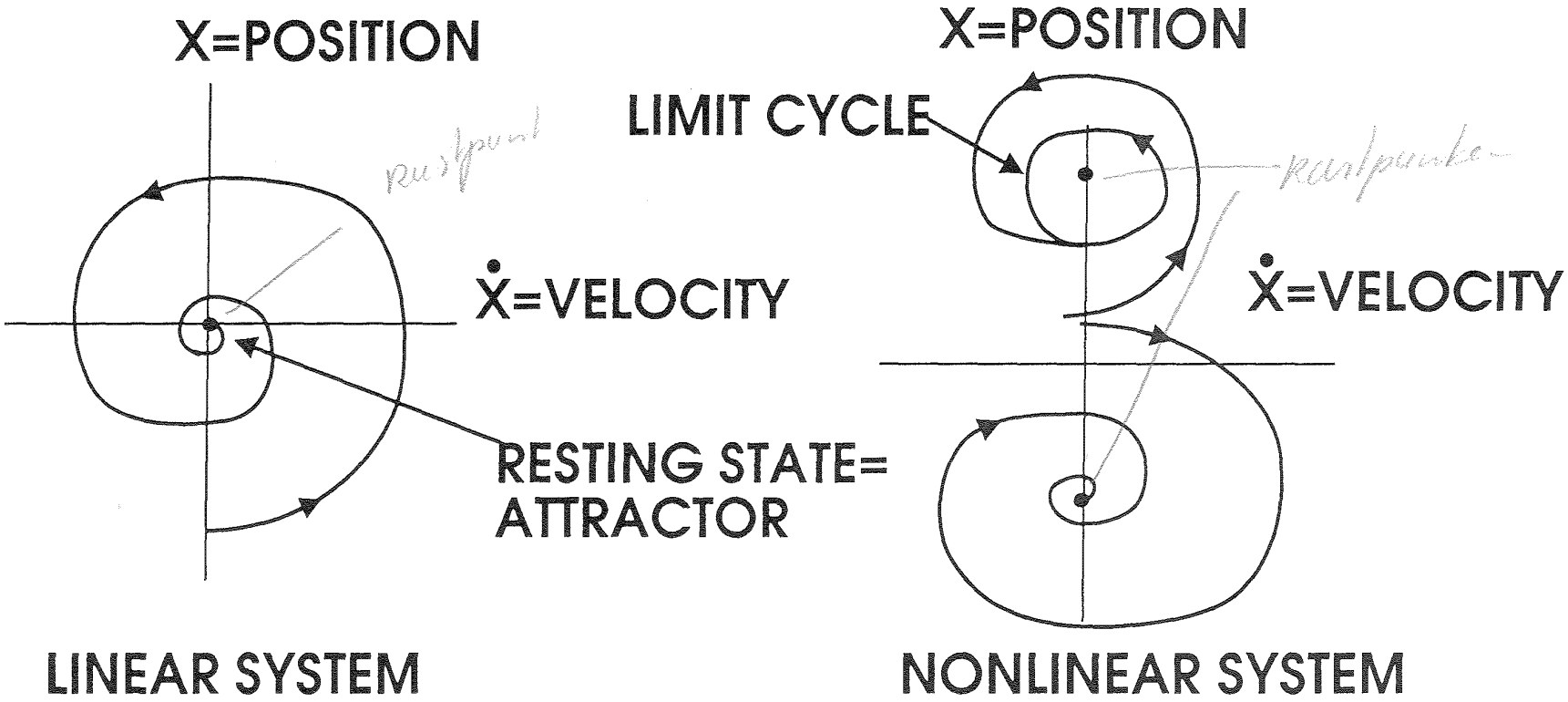
F(alpha) +F(beta) =0

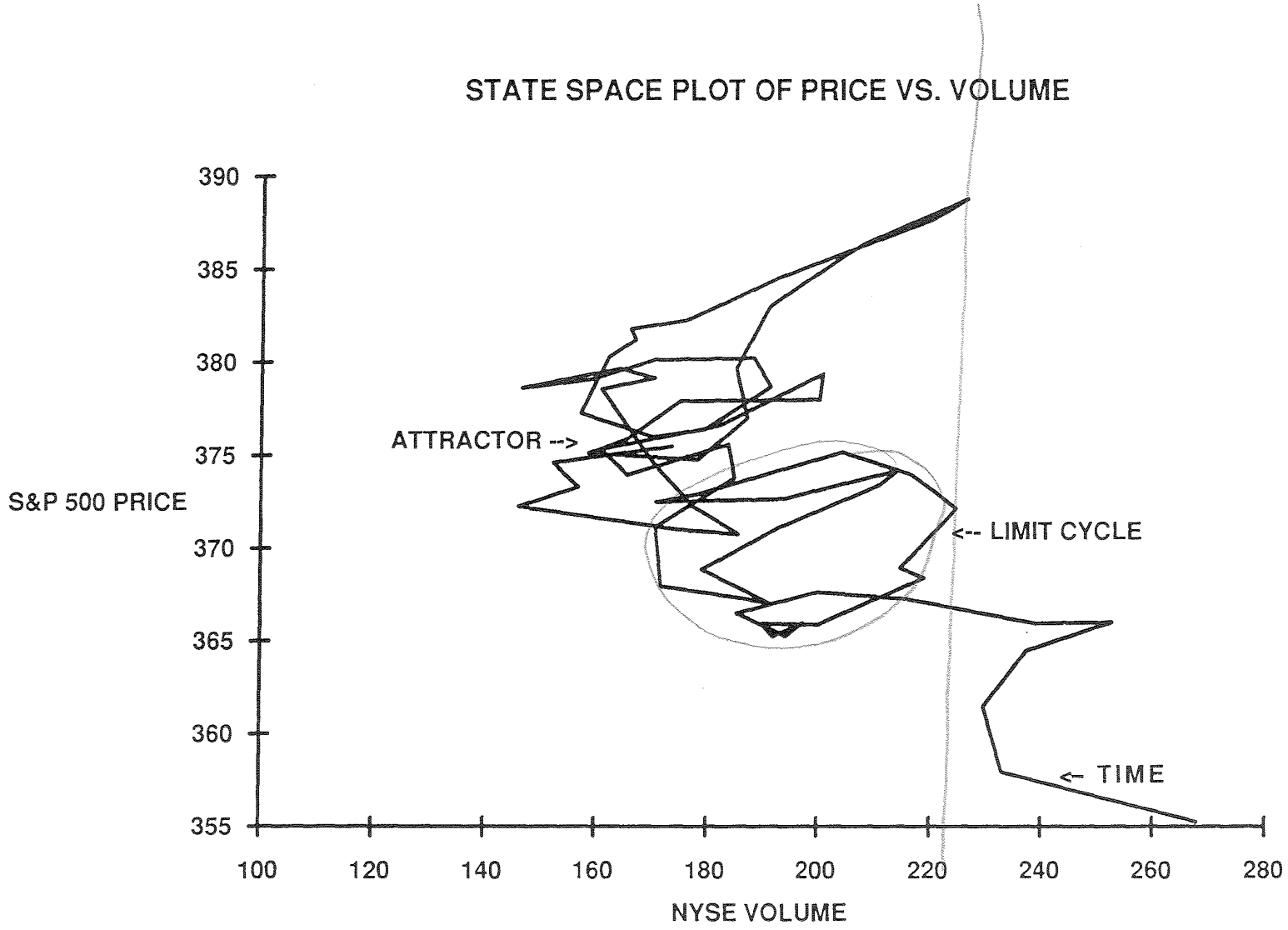
1. Sensitive to initial conditions
2. can take several forms
a. crash on alpa
b. orbit alpa
c. orbit beta
d. orbit both
e. crash on beta

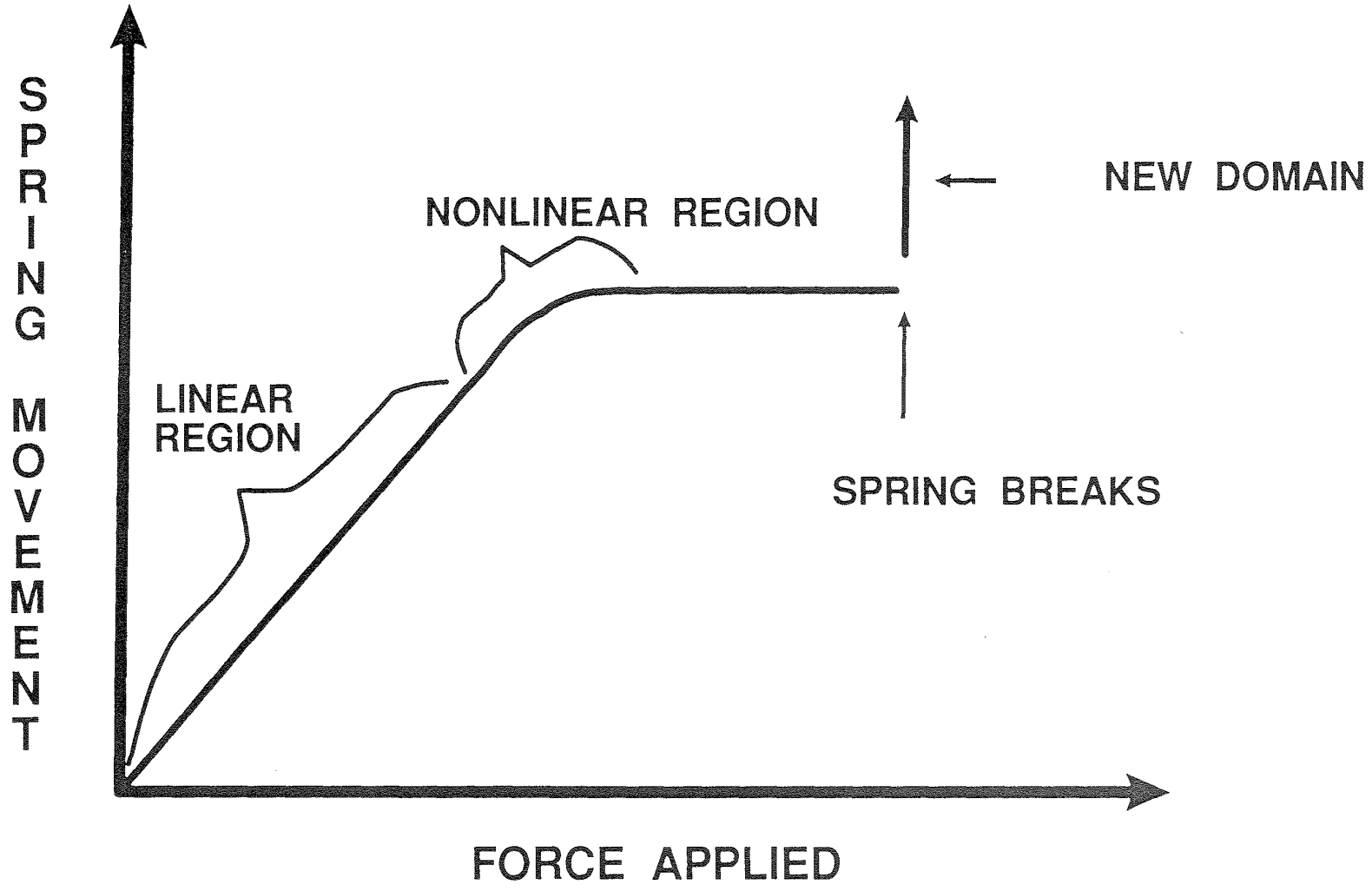
Behavior of Nonlinear Systems

STATE SPACE

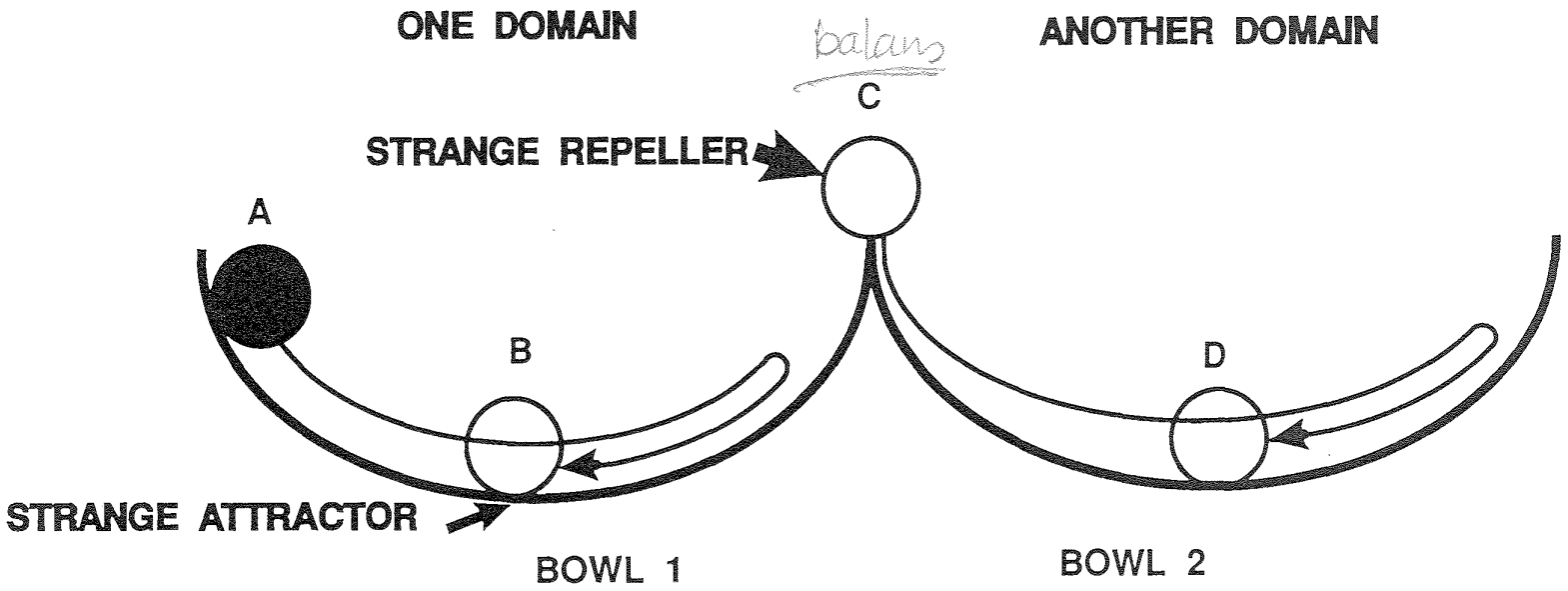
is a plot of one system "state" or property, such as position, versus another, such as velocity. Time is omitted, except as it evolves along the plot. This gives a nice graphic tool for looking at systems.




STATE SPACE PLOT OF PRICE VS. VOLUME
390
385
380
375
370
365
360
355
S&P 500 PRICE
ATTRACTOR -->
<-- LIMIT CYCLE
<- TIME
100
120
140
160
180
200
220
240
260
280
NYSE VOLUME



LINEAR AND NONLINEAR MOTION



CHAOTIC BEHAVIOR

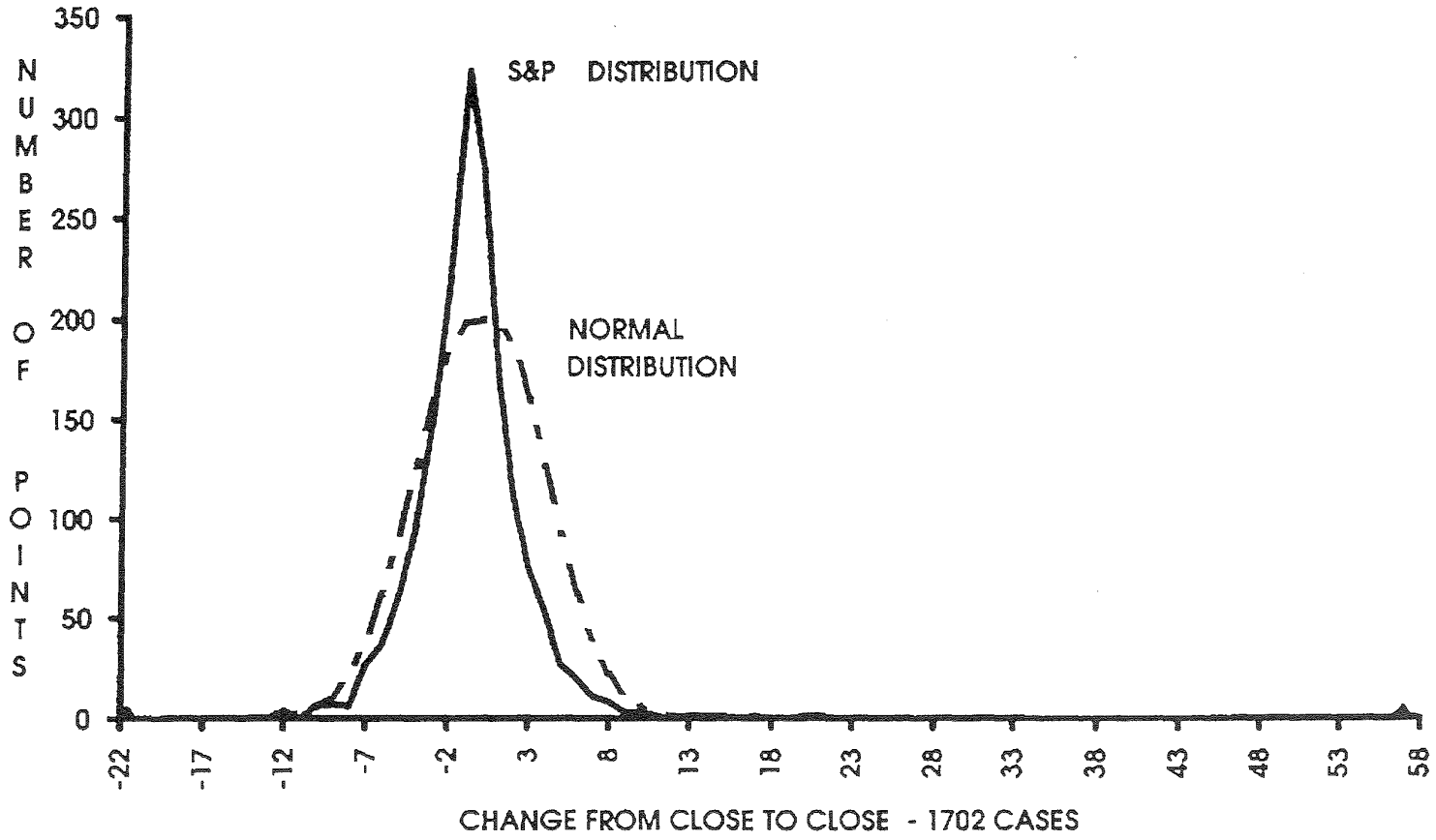
CHAOTIC SYSTEMS

-ARE NONLINEAR
-ARE NOT RANDOM
-DESCRIBE MANY NATURAL SYSTEMS
-EXPLAIN HOW SMALL FORCES CAN
HAVE A BIG EFFECT
-CAN, DO, AND WILL MAKE SUDDEN AND
ABRUPT CHANGES OF STATE

-ARE DESCRIBED BY MANDELBROT'S FRACTAL GEOMETRY
- -not Euclidian
- -shapes have
  - scaling effects
  - self-simularity
  - fractal dimension

-ARE DESCRIBED BY PARETIAN STATISTICS, NOT GUASSIAN
- -invalidates the Efficient Market Theory
  (and related things, like option pricing model)
- -permits vertical gaps in data
- -data can be mathematically tested

S&P 500 DAILY CHANGE DISTRIBUTION



TESTING WITH THE HURST EXPONENT

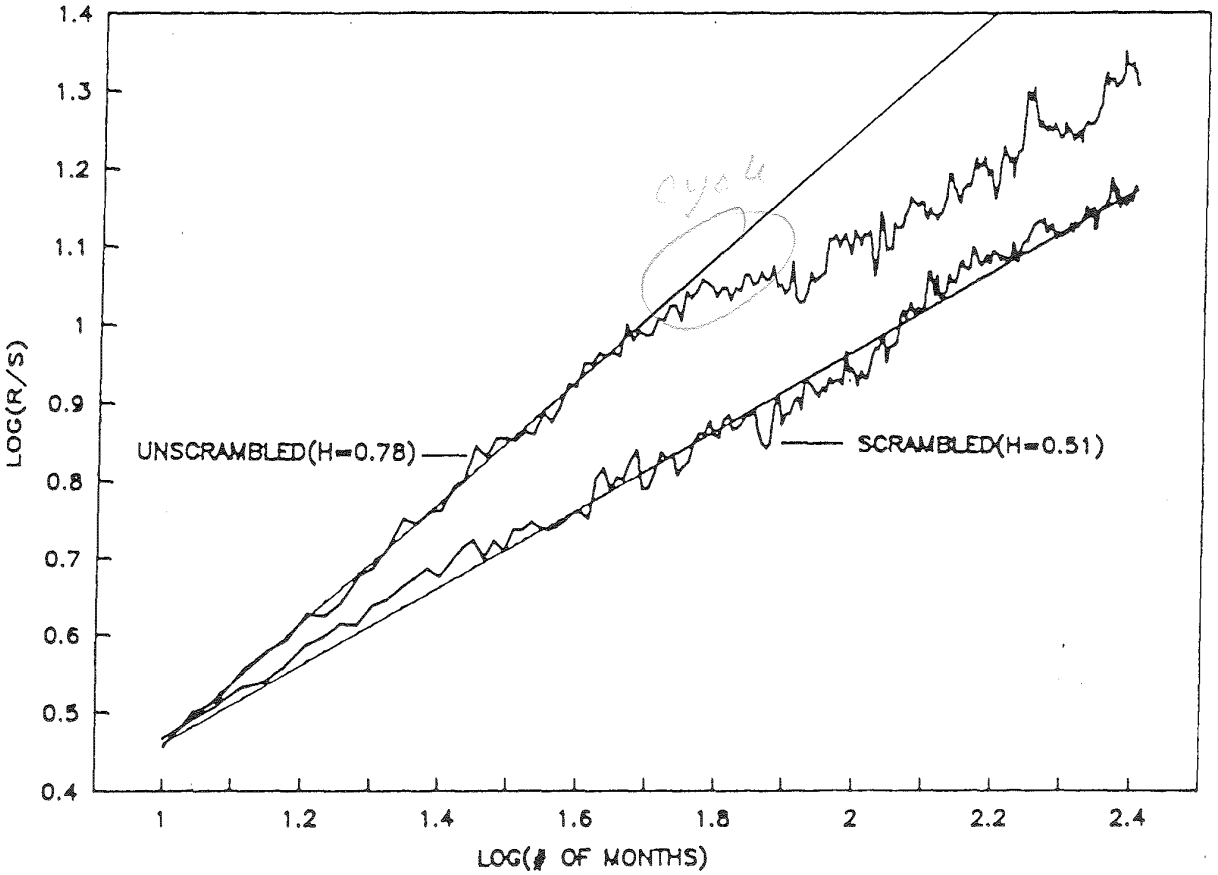
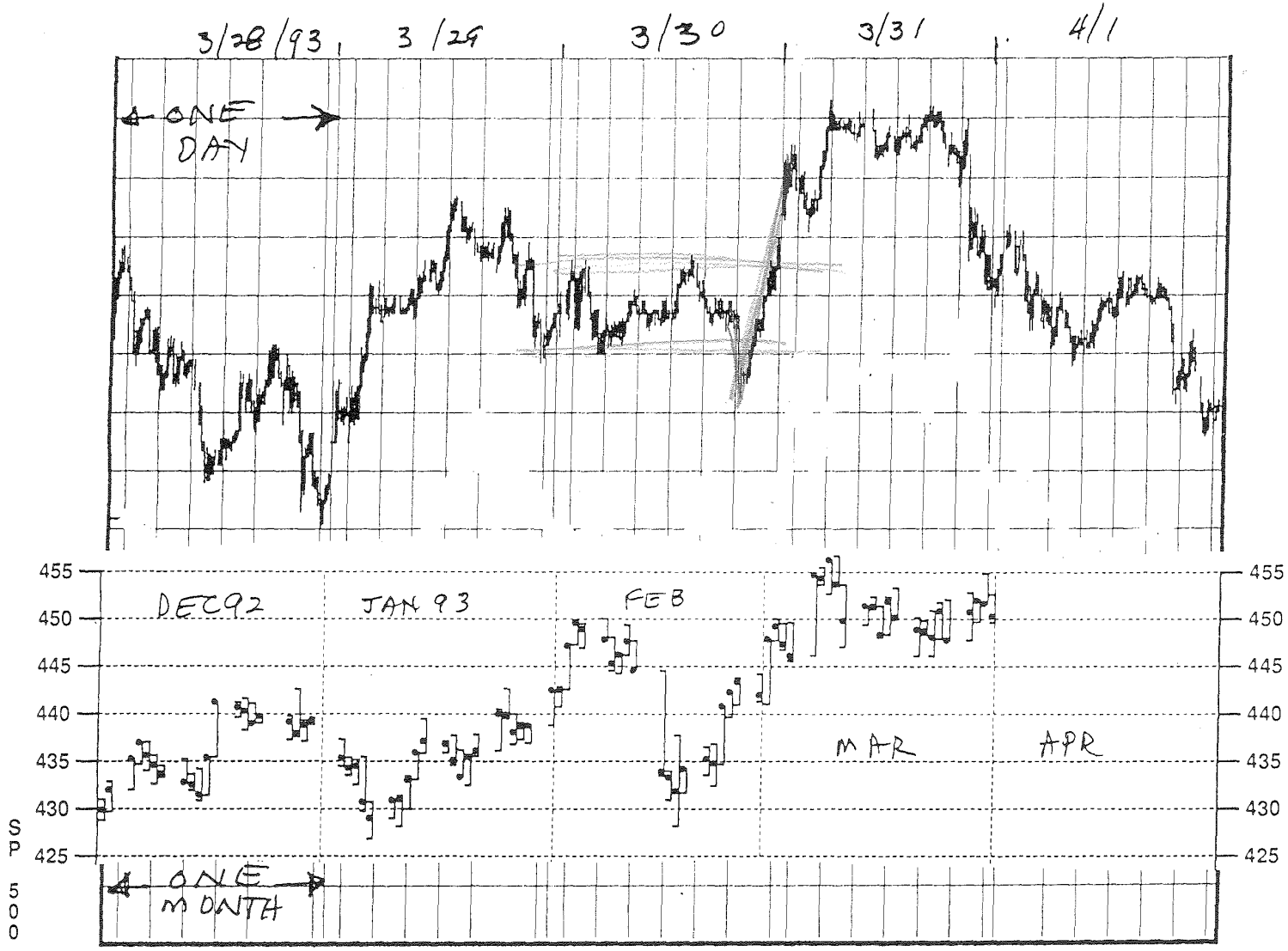


FIGURE 8.3 Scrambling test: S&P 500 monthly returns, January 1950–July 1988. Unscrambled H = 0.78; scrambled H = 0.51.

from Edgar E. Peters,
CHAOS and ORDER in the CAPITAL MARKETS,
John Wiley, 1991

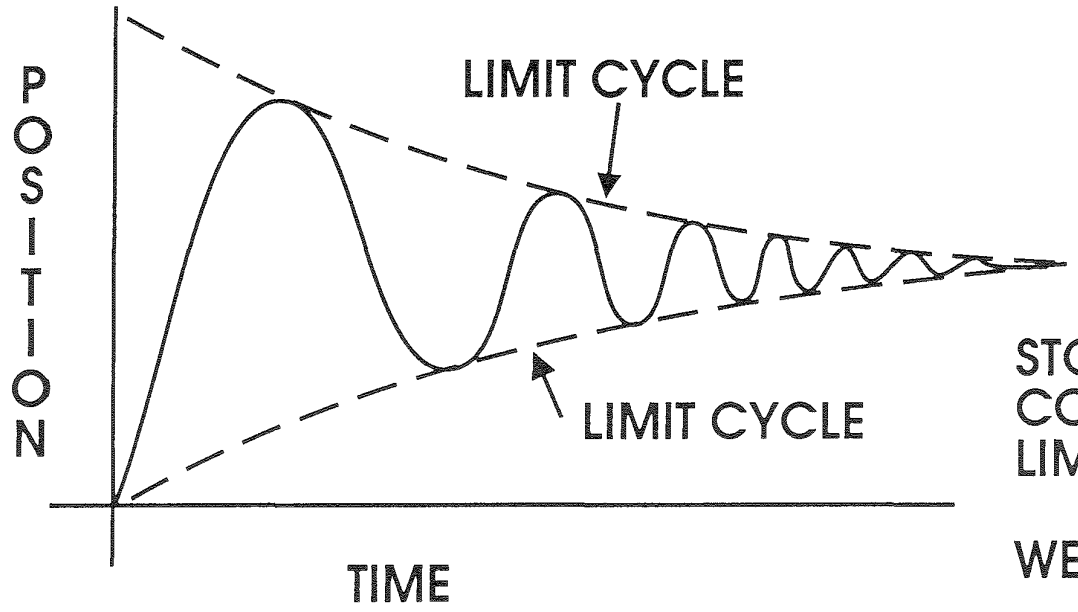
FRACTAL SELF-SIMILARITY AND SCALING



Limit Cycles

LIMIT CYCLES

LIMIT CYCLES ARE
- PERFORMANCE ENVELOPES OF A SYSTEM
- USUSALLY NOT PLOTTED OR SEEN
- THE MOST IMPORTANT THING YOU HAVE NEVER SEEN IN MARKETS



EXAMPLE: AUTO MASS,SPRING,DAMPER

STOCKS AND COMMODITIES HAVE LIMIT CYCLES.

WE CALL THEM trendlines

THEY ARE BOTH _____
AND _____

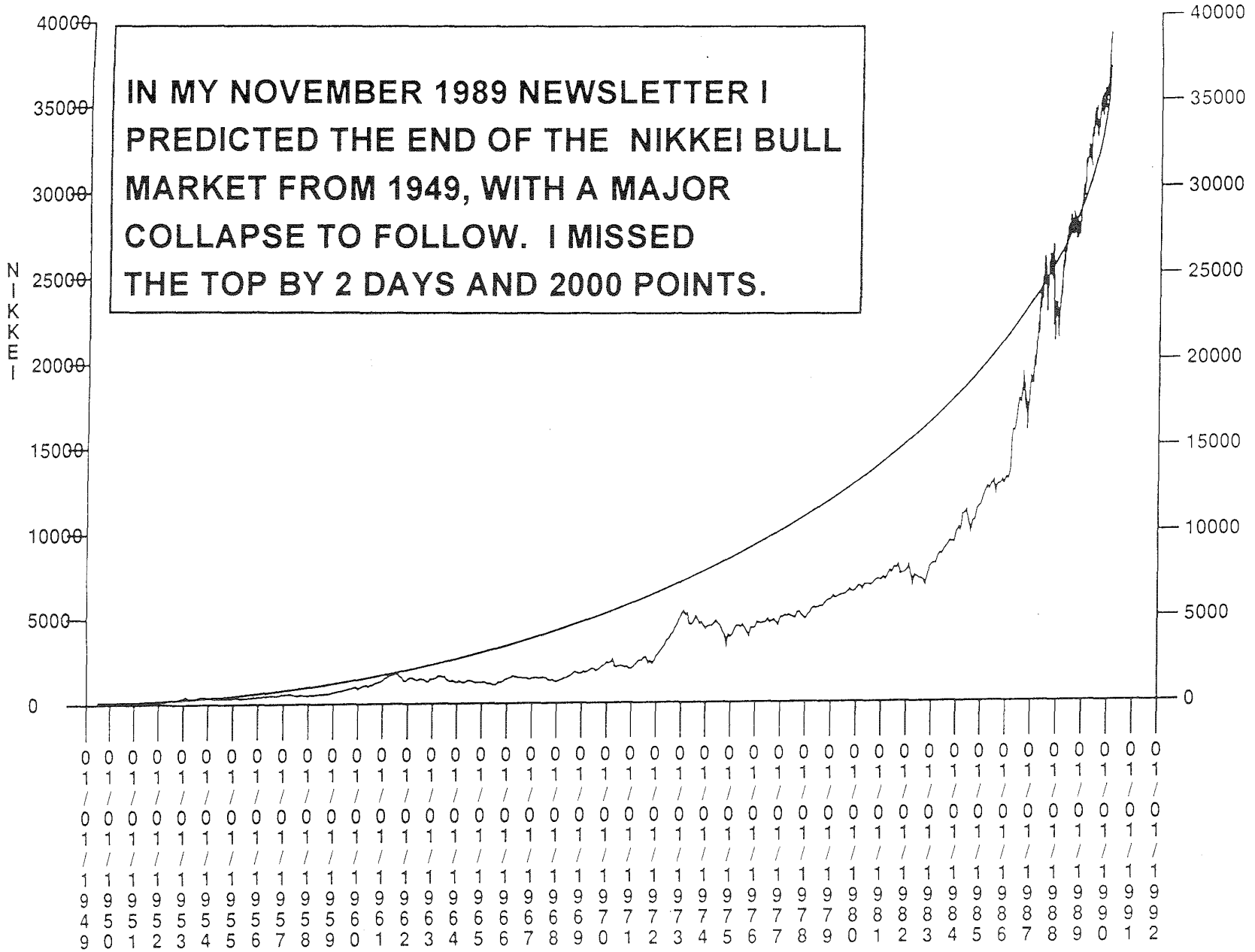


FIGURE 7. NATURAL GROWTH BOUNDARY OF THE NIKKEI

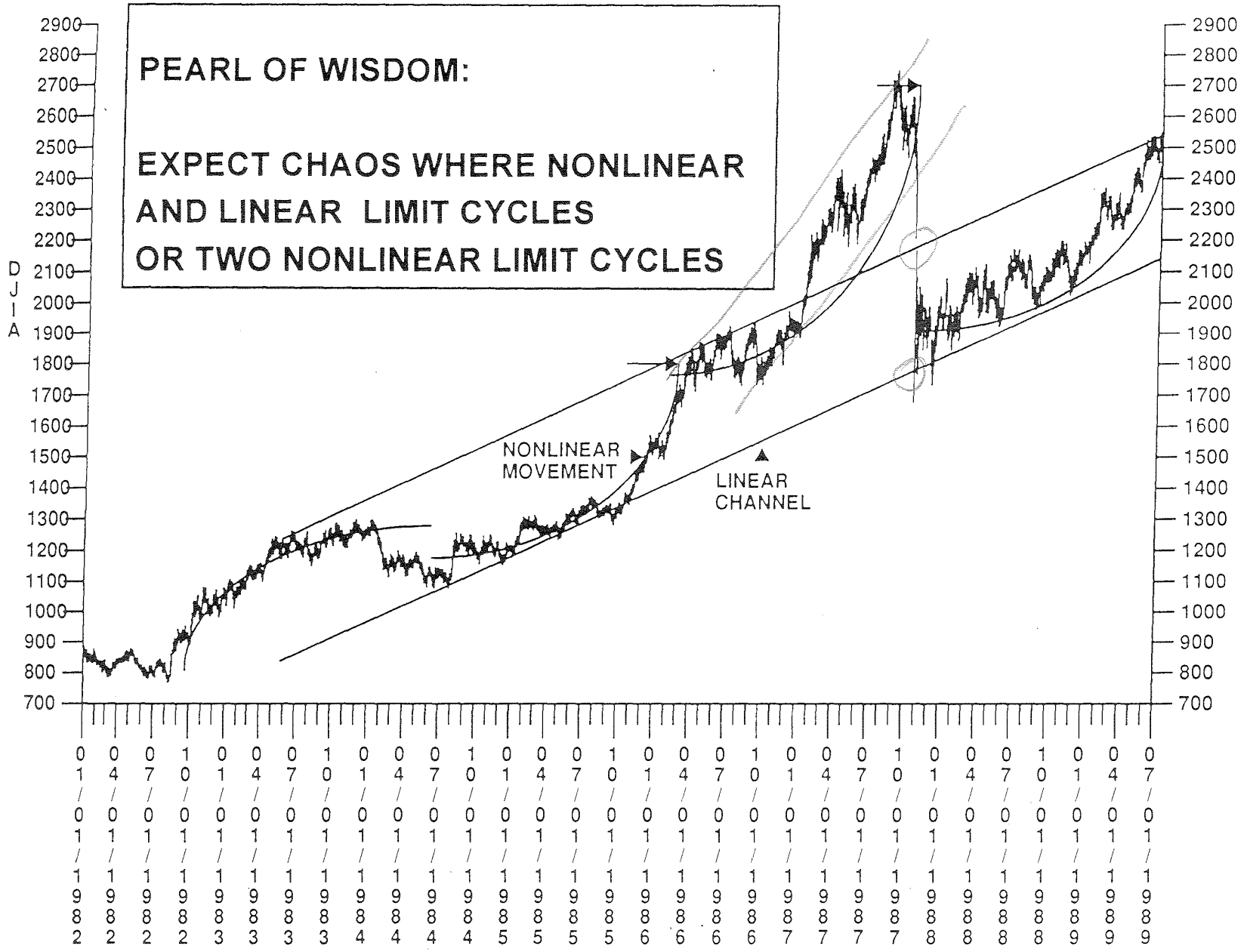
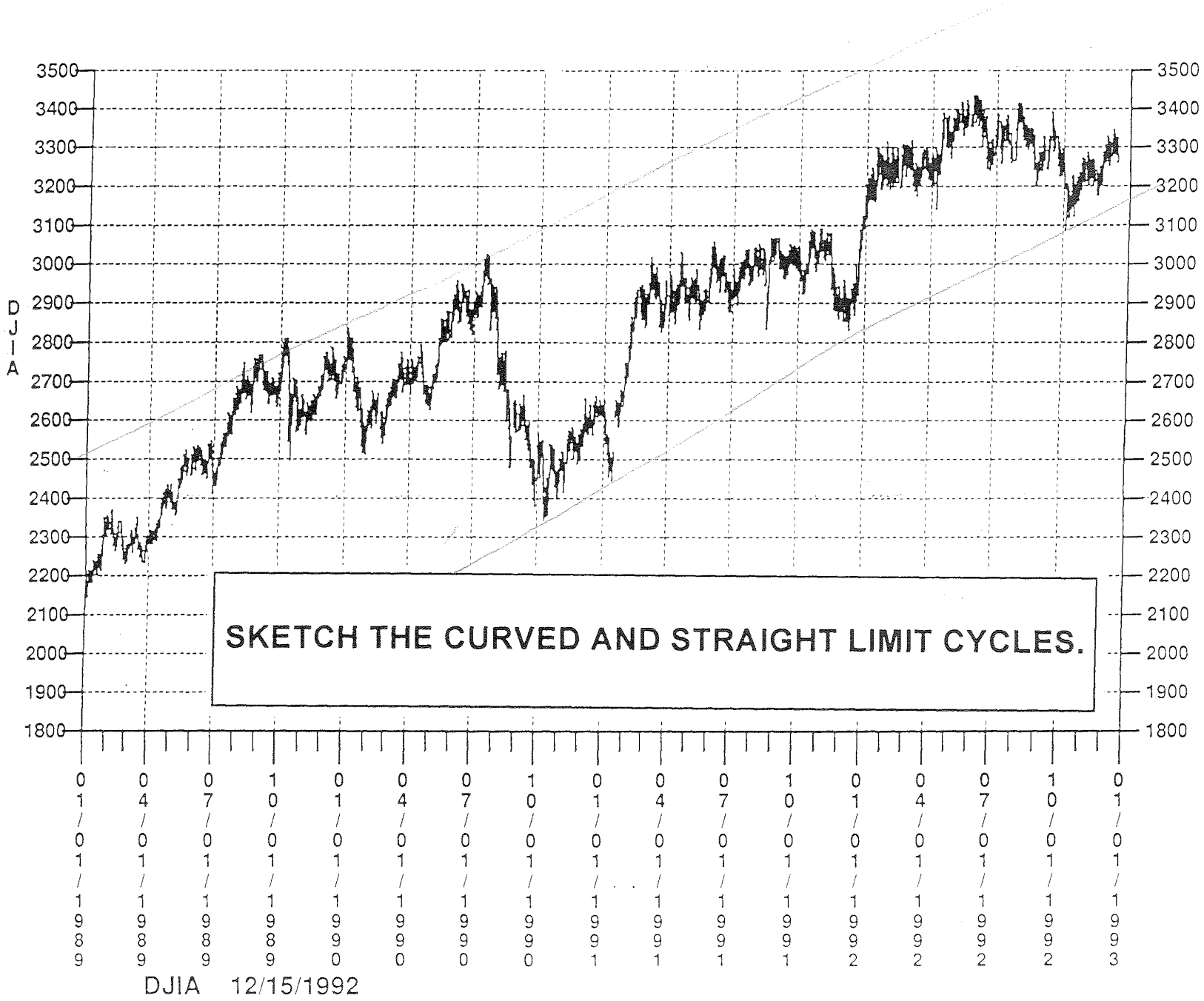
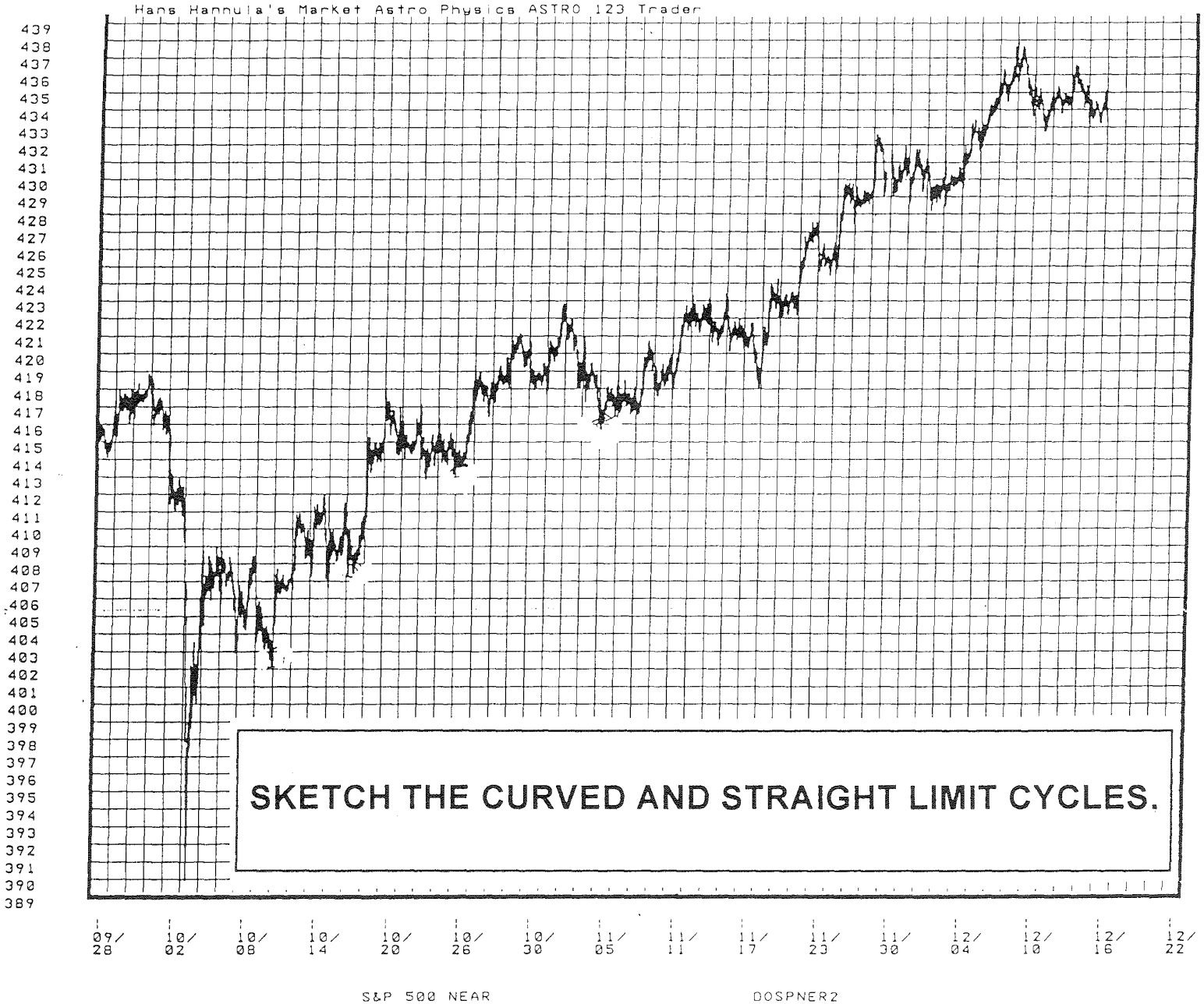


FIGURE 4. THE DOW WITH LINEAR AND NONLINEAR MOTION


DJIA
3500
3400
3300
3200
3100
3000
2900
2800
2700
2600
2500
2400
2300
2200
2100
2000
1900
1800
SKETCH THE CURVED AND STRAIGHT LIMIT CYCLES.
01/01/1989
04/01/1989
07/01/1989
10/01/1989
01/01/1990
04/01/1990
07/01/1990
10/01/1990
01/01/1991
04/01/1991
07/01/1991
10/01/1991
01/01/1992
04/01/1992
07/01/1992
10/01/1992
01/01/1993
DJIA 12/15/1992


Hans Hannula's Market Astro Physics ASTRO 123 Trader
439
438
437
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424
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420
419
418
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408
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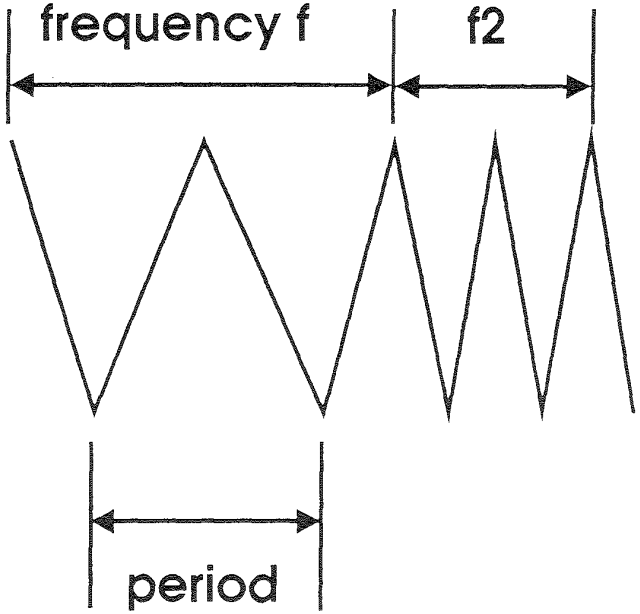
396
395
394
393
392
391
390
389
SKETCH THE CURVED AND STRAIGHT LIMIT CYCLES.
09/ 28
10/ 02
10/ 08
10/ 14
10/ 20
10/ 26
10/ 30
11/ 05
11/ 11
11/ 17
11/ 23
11/ 30
12/ 04
12/ 10
12/ 16
12/ 22
S&P 500 NEAR
DOSPNER2

Frequency Shifts

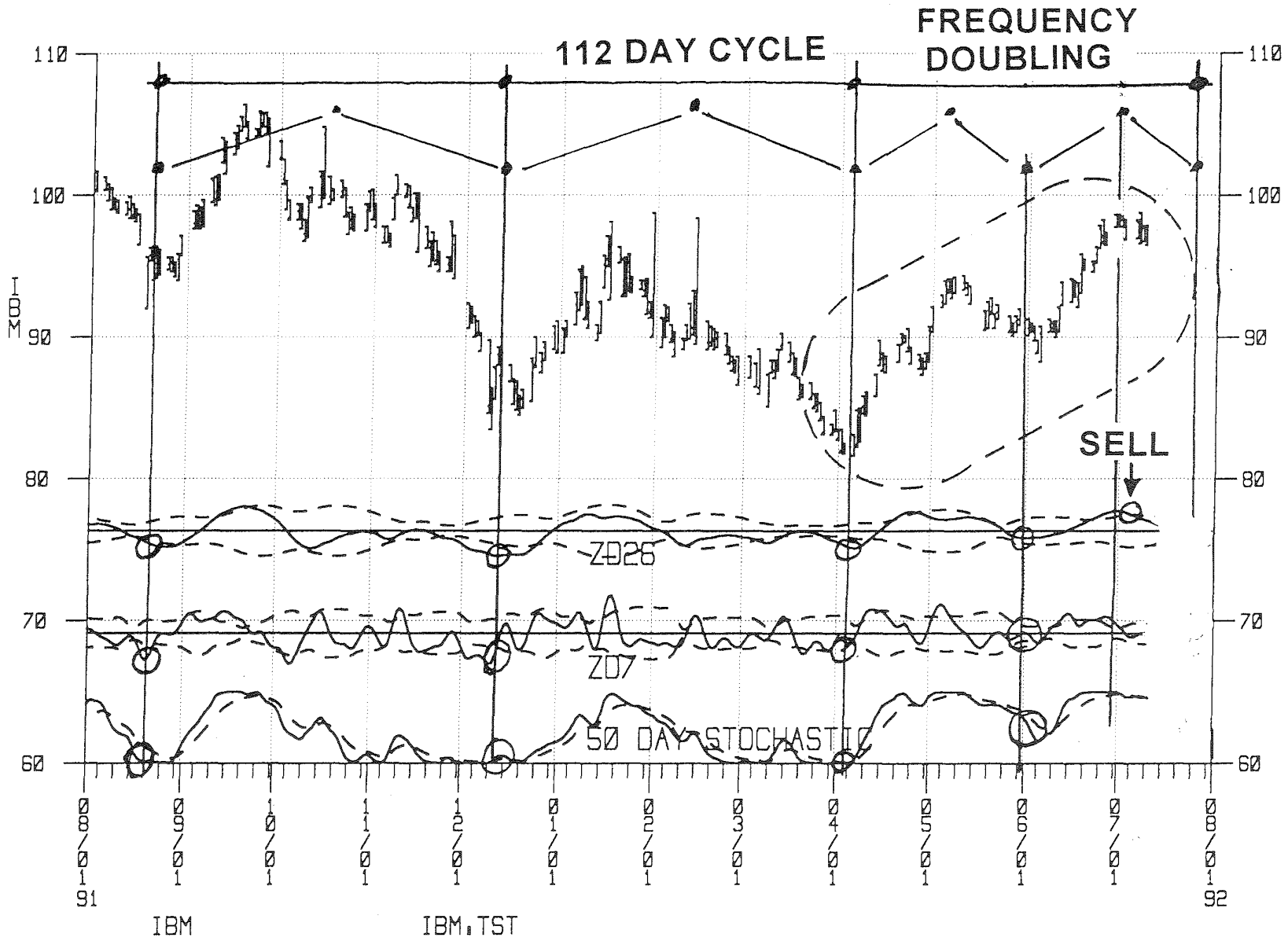
FREQUENCY SHIFTS

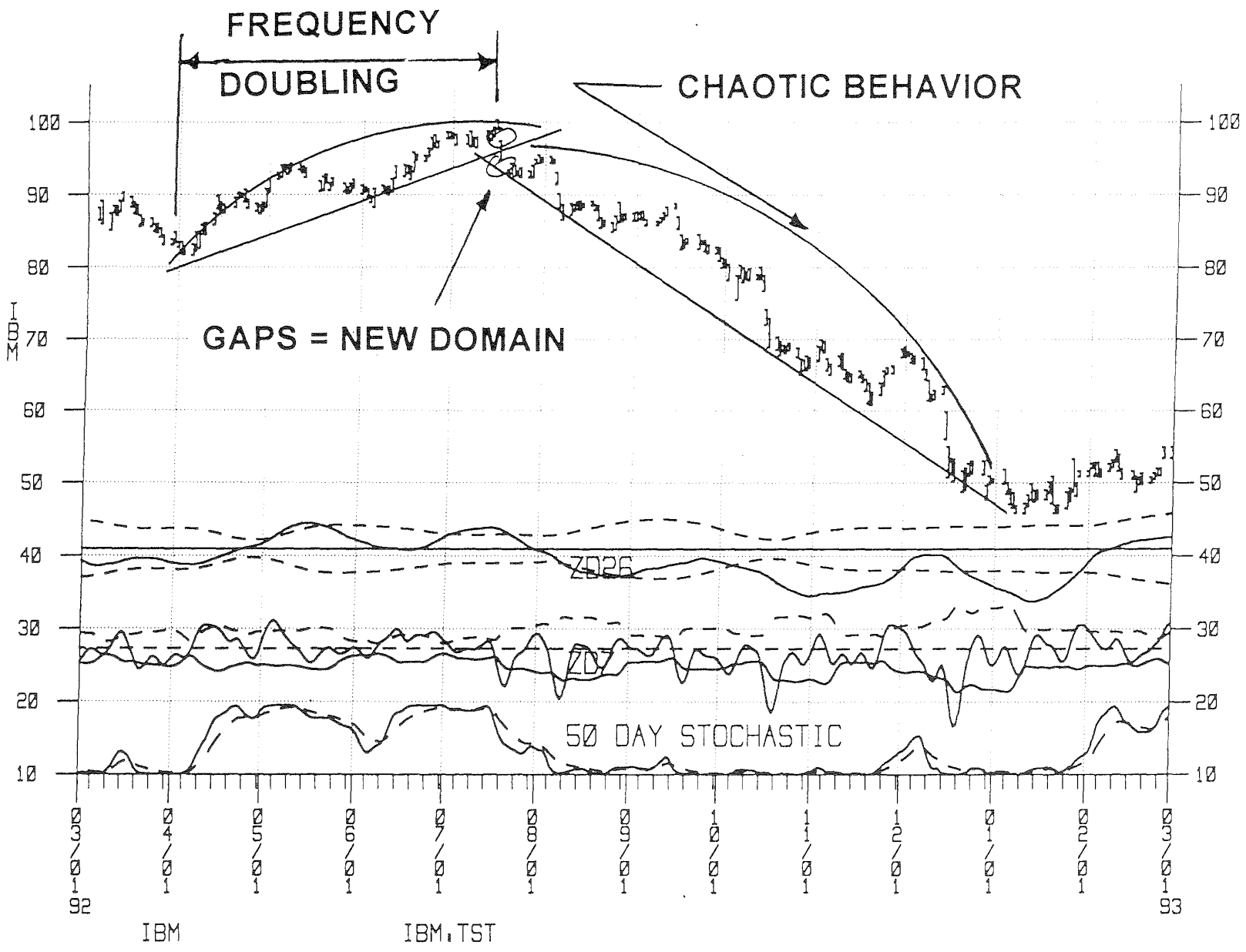
CHAOTIC SYSTEMS OFTEN EXHIBIT A DOUBLING OF FREQUENCY JUST BEFORE ENTERING CHAOTIC BEHAVIOR.



frequency = 1 / period

measures how fast things change

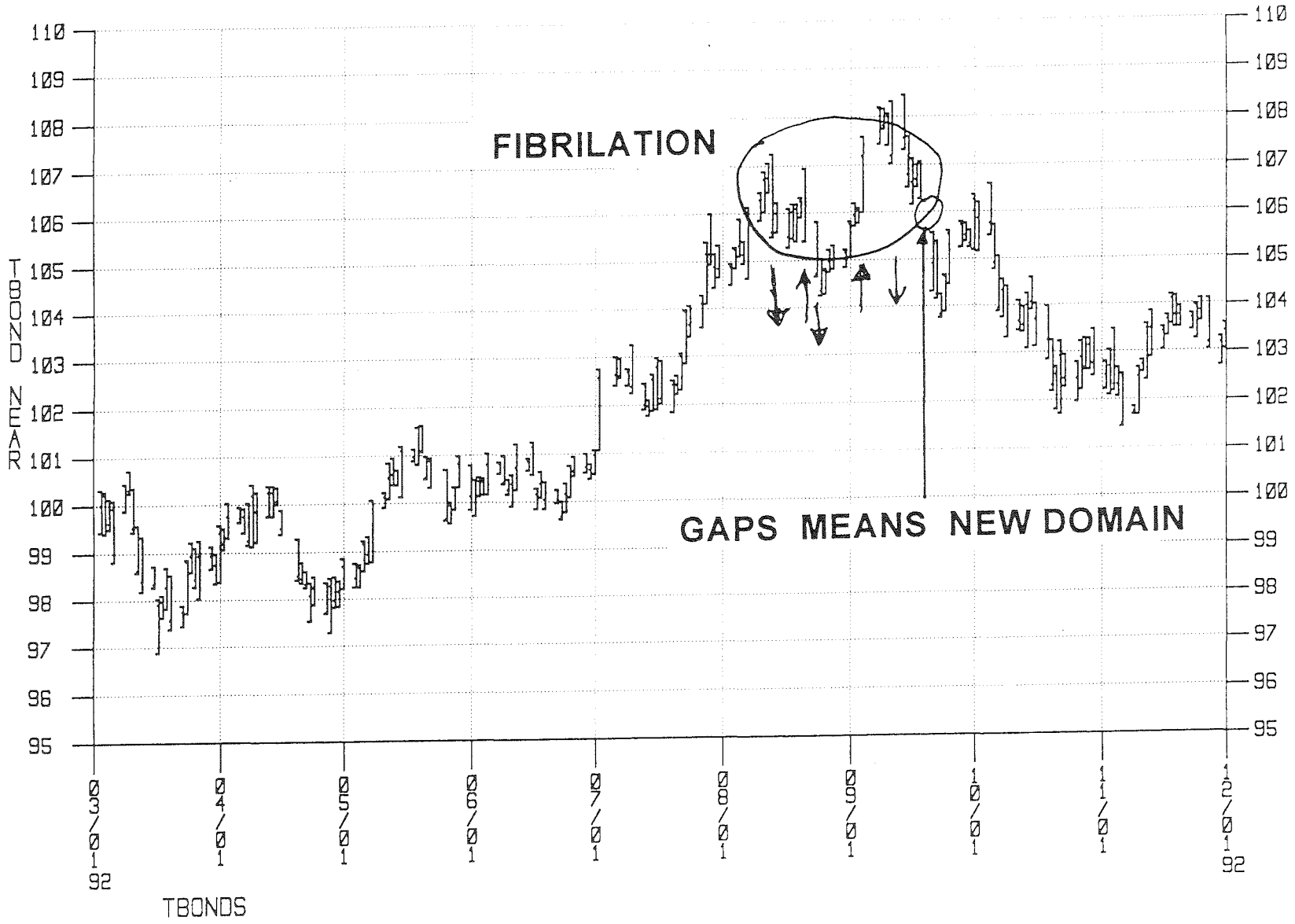

112 DAY CYCLE
FREQUENCY DOUBLING
SELL
ZD26
ZD7
50 DAY STOCHASTIC
IBM
110
100
90
80
70
60
08/01/91
09/01/01
10/01/01
11/01/01
12/01/01
01/01/01
02/01/01
03/01/01
04/01/01
05/01/01
06/01/01
07/01/01
08/01/92
IBM
IBM.TST


FREQUENCY
DOUBLING
CHAOTIC BEHAVIOR
GAPS = NEW DOMAIN
IBM
100
90
80
70
60
50
40
30
20
10
ZD26
ZD
50 DAY STOCHASTIC
03/01/92
04/01/01
05/01/01
06/01/01
07/01/01
08/01/01
09/01/01
10/01/01
11/01/01
12/01/01
01/01/01
02/01/01
03/01/93
IBM
IBM.TST

FIBRILATION

FIBRILATION IS A CONDITION WHERE
THE RYTHMIC MOTION "looses its beat"
AND CHANGES VERY RAPIDLY.

IT IS FOLLOWED BY CHAOS.


FIBRILATION
GAPS MEANS NEW DOMAIN
TBOND NEAR
TBONDS
110
109
108
107
106
105
104
103
102
101
100
99
98
97
96
95
03/01/92
04/01/1
05/01/1
06/01/1
07/01/1
08/01/1
09/01/1
10/01/1
11/01/1
12/01/92

HEART ATTACKS ARE A WELL KNOWN EXAMPLE OF FREQUENCY SHIFTS AS PRECURSORS TO CHAOS

Imagine shovelling heavy, wet, spring snow:

1. Load increases
2. Heart pumps harder
3. Heartbeat jumps to twice as fast
4. If you don't act .....
5. Heart enters fibrilation
6. Heart attack occurs

MONITORING FREQUENCY SHIFTS

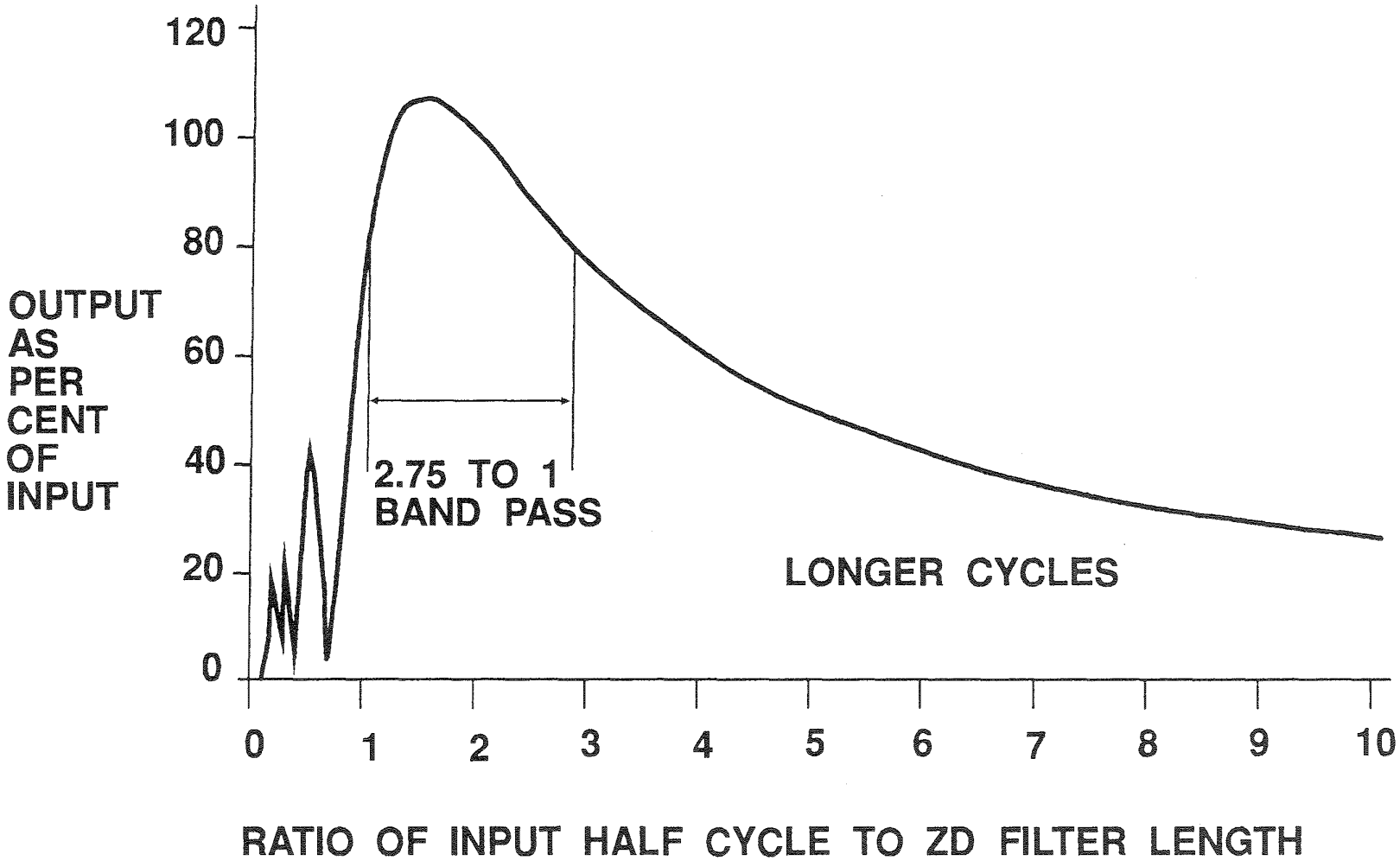
CHAOTIC SYSTEMS MAY BE MONITORED FOR FREQUENCY SHIFTING USING SPECIAL FILTERS. MY

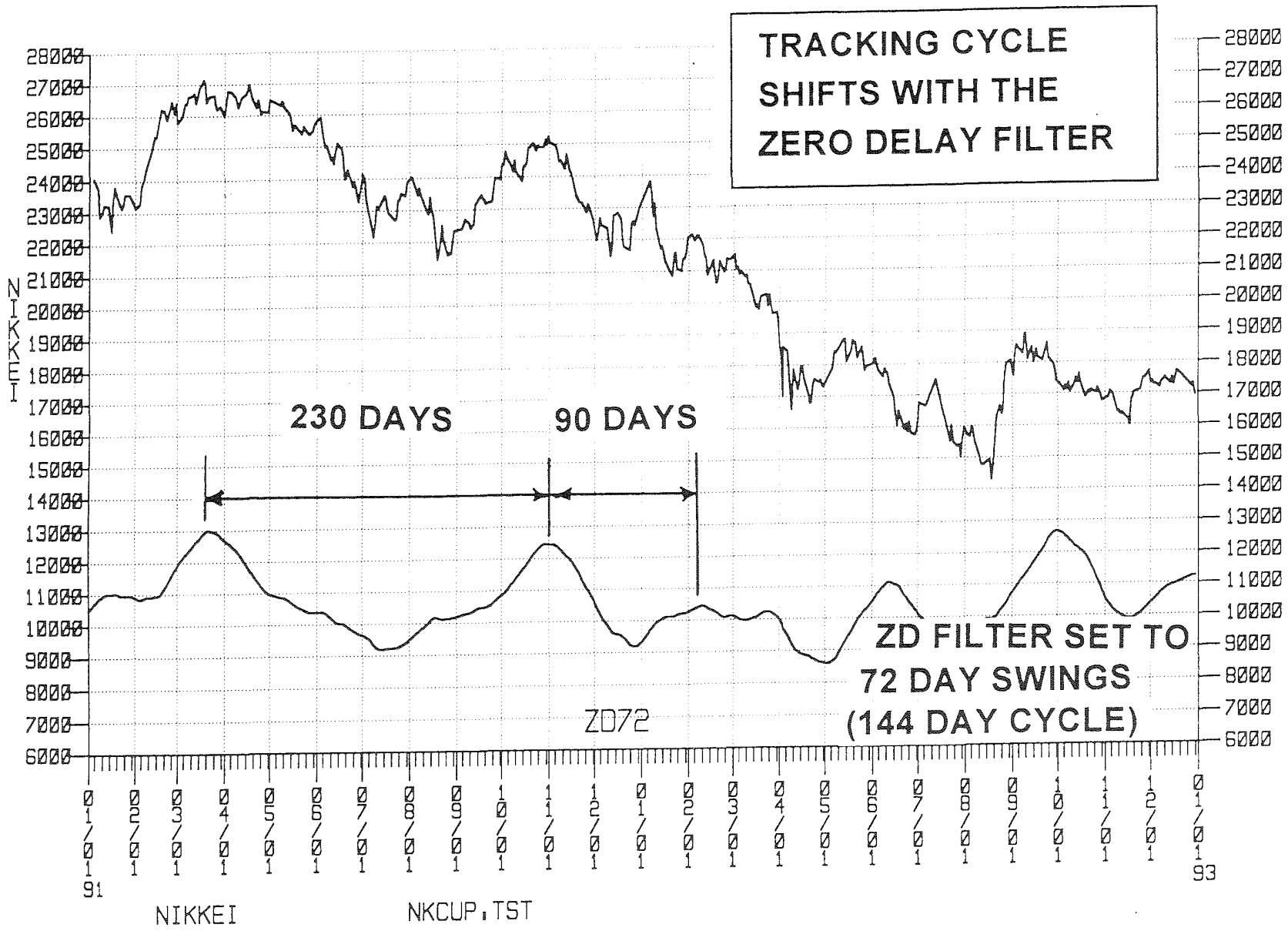
ZERO DELAY FILTER

WAS DESIGNED FOR THIS PURPOSE.

THE ZD FILTER

- -tracks swings, rather that cycles
- -can follow swings that vary over a 1 to 2.75 range from an average value
- -turns down or up when the energy cycle does


120
100
80
60
40
20
0
OUTPUT AS PER CENT OF INPUT
2.75 TO 1 BAND PASS
LONGER CYCLES
0
1
2
3
4
5
6
7
8
9
10
RATIO OF INPUT HALF CYCLE TO ZD FILTER LENGTH


TRACKING CYCLE
SHIFTS WITH THE
ZERO DELAY FILTER
230 DAYS
90 DAYS
ZD FILTER SET TO
72 DAY SWINGS
(144 DAY CYCLE)
ZD72
NIKKEI
NIKKEI
NKCUP:TST

Fractal Dimension

FRACTAL GEOMETRY

- INVENTED BY BENOIT MANDELBROT

- FIRST NEW GEOMETRY SINCE EUCLID'S (ancient Greece)

- COMES FROM " FRACTIONAL DIMENSION "

Euclidean Geometry

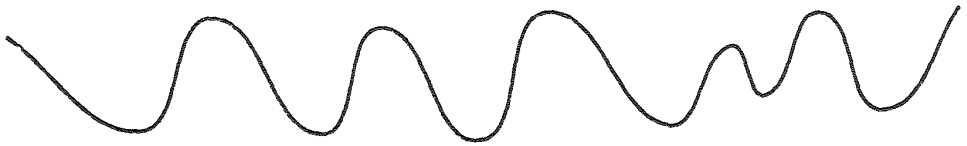
1 D - line
2 D - plane or surface
3 D - volumes, such as cube, sphere

BUT HOW DO YOU DESCRIBE A LINE
THAT IS "INFINITELY SQUIGGLY" ?

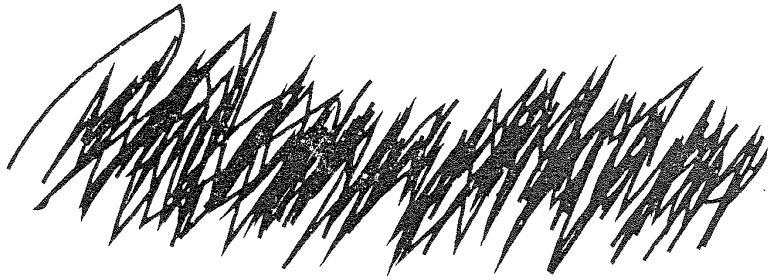
GEOMETRIC DIMENSIONS

STRAIGHT LINE
D=1

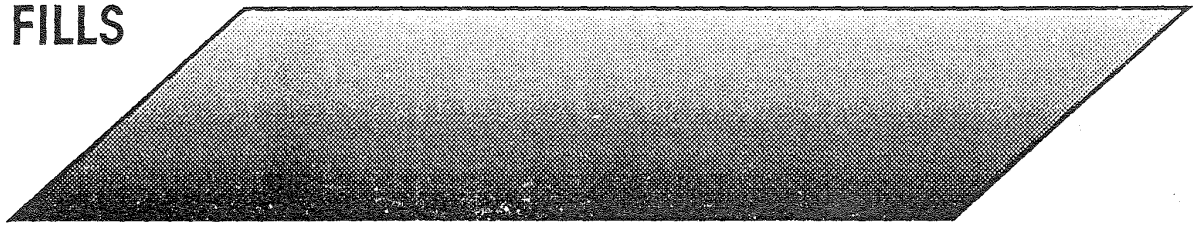
LOW SQUIGGLE
D=1.1



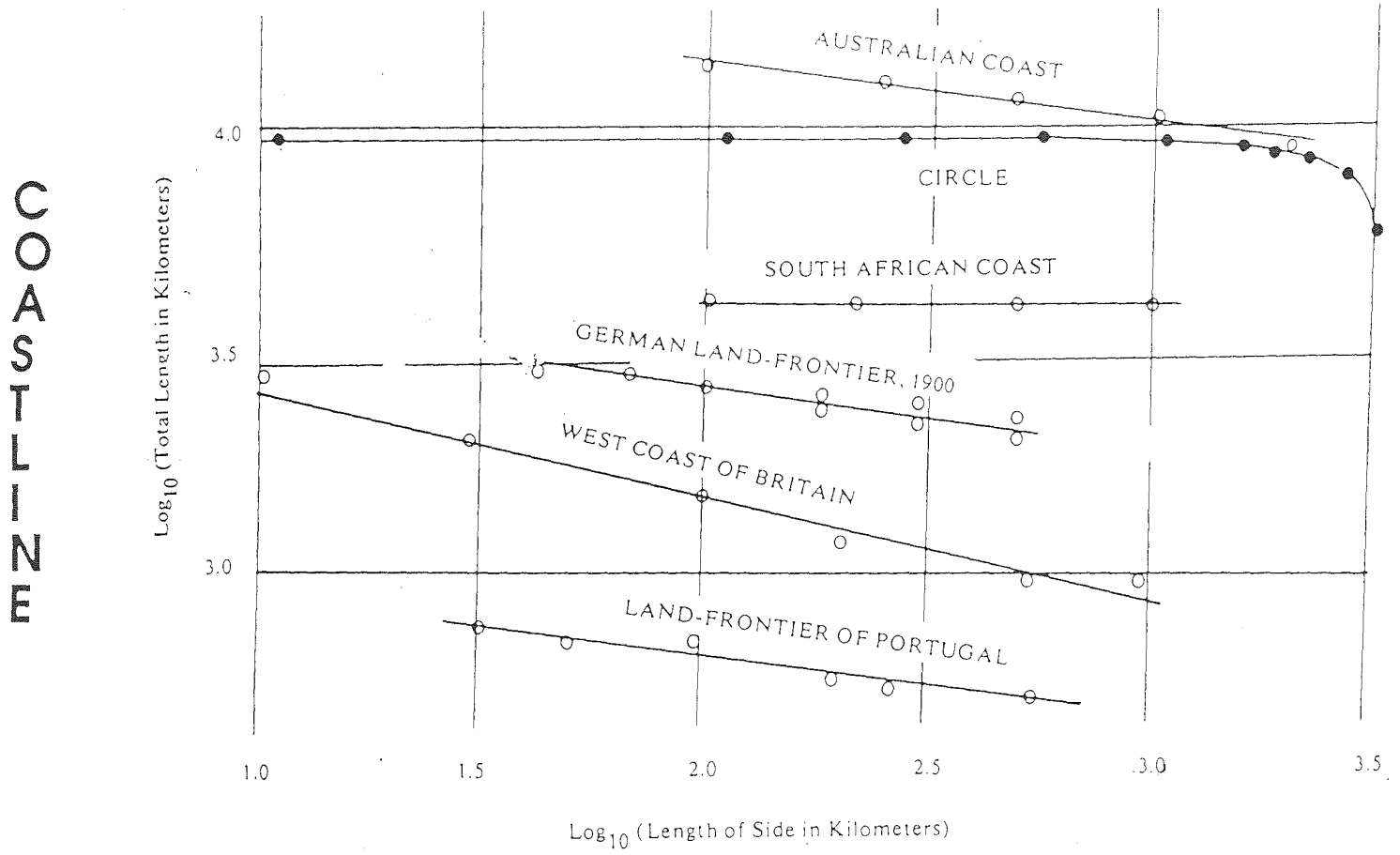
HIGH SQUIGGLE
D=1.6



SQUIGGLE FILLS
PLANE
D=2

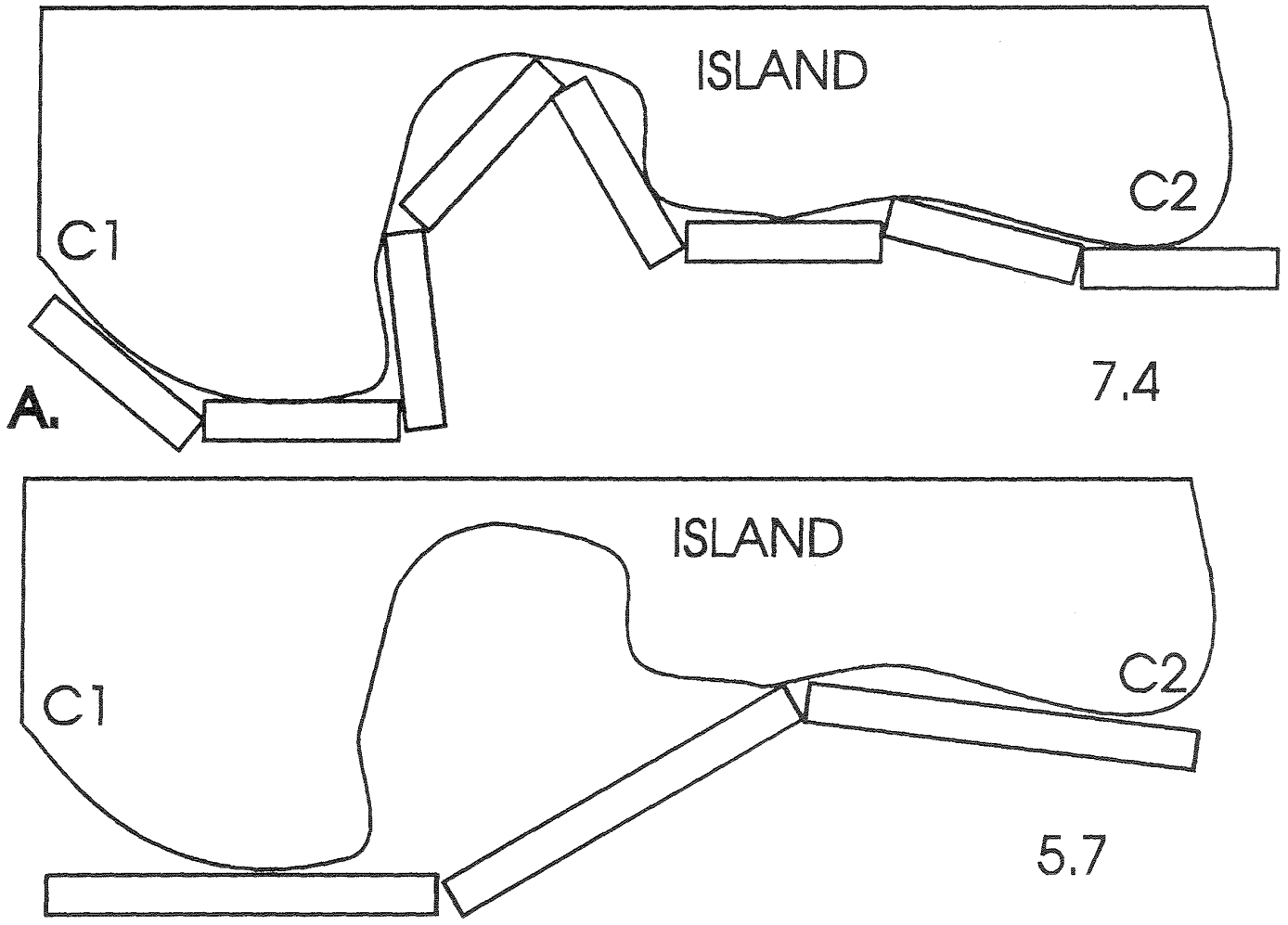


RICHARSON'S COASTLINE DATA



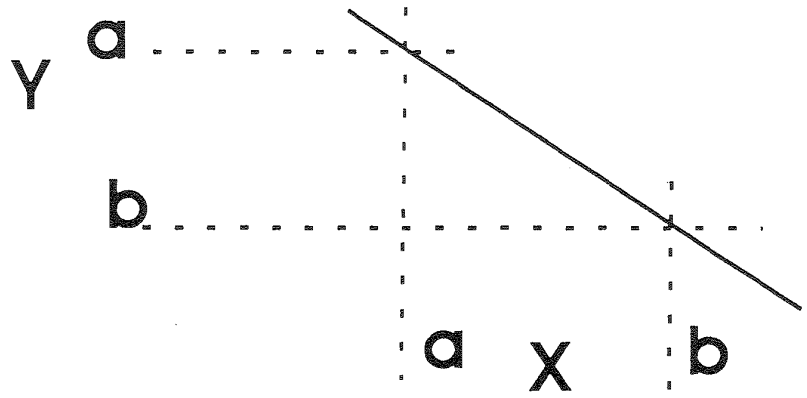
SLOPE = 1 - FRACTAL DIMENSION

from THE FRACTAL GEOMETRY OF NATURE, by Benoit Madelbrot


ISLAND
C2
C1
7.4
A.
ISLAND
C2
C1
5.7
B.

ALGEBRA OF THE COASTLINE DIMENSION

$$\text{slope} = \frac{\text{change in X}}{\text{change in Y}}$$



1-D = SLOPE OF COASTLINE ON LOG/LOG PLOT

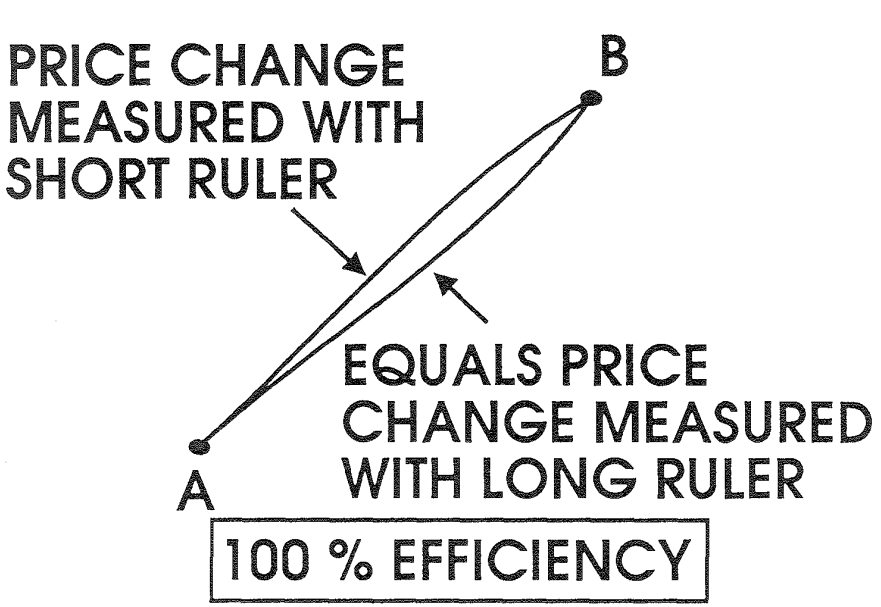
$$1\text{-}D = \frac{LOG\ Yb - LOG\ Ya}{LOG\ Xb - LOG\ Xa}$$

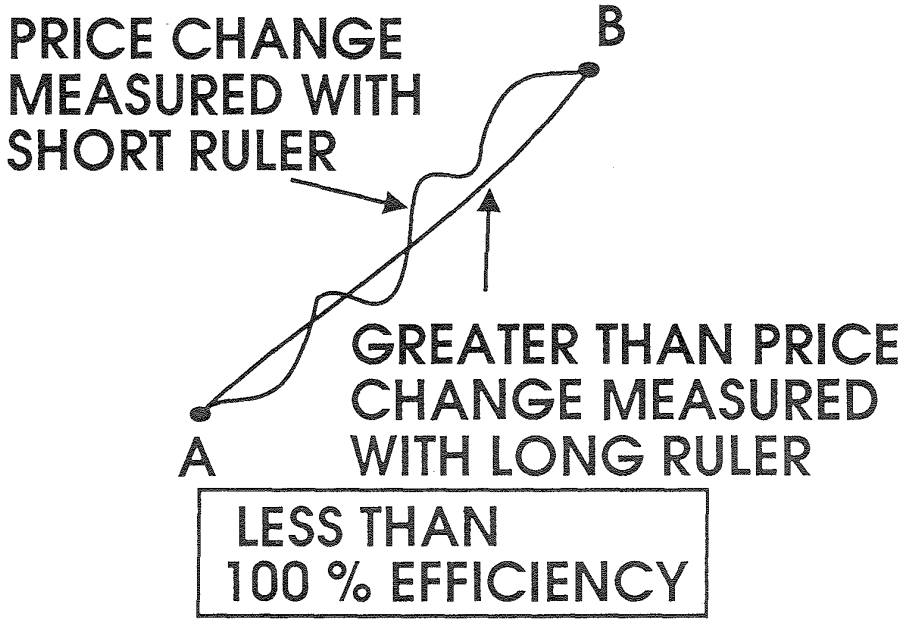
$$D = \frac{LOG\ Yb - LOG\ Ya}{LOG\ Xb - LOG\ Xa} + 1$$

where: Xa is length of short ruler
Xb is length of long ruler
Ya is length of coast measured with short ruler
Yb is length of coast measured with long ruler

POLARIZED FRACTAL EFFICIENCY

HOW EFFICIENTLY IS PRICE MOVING?



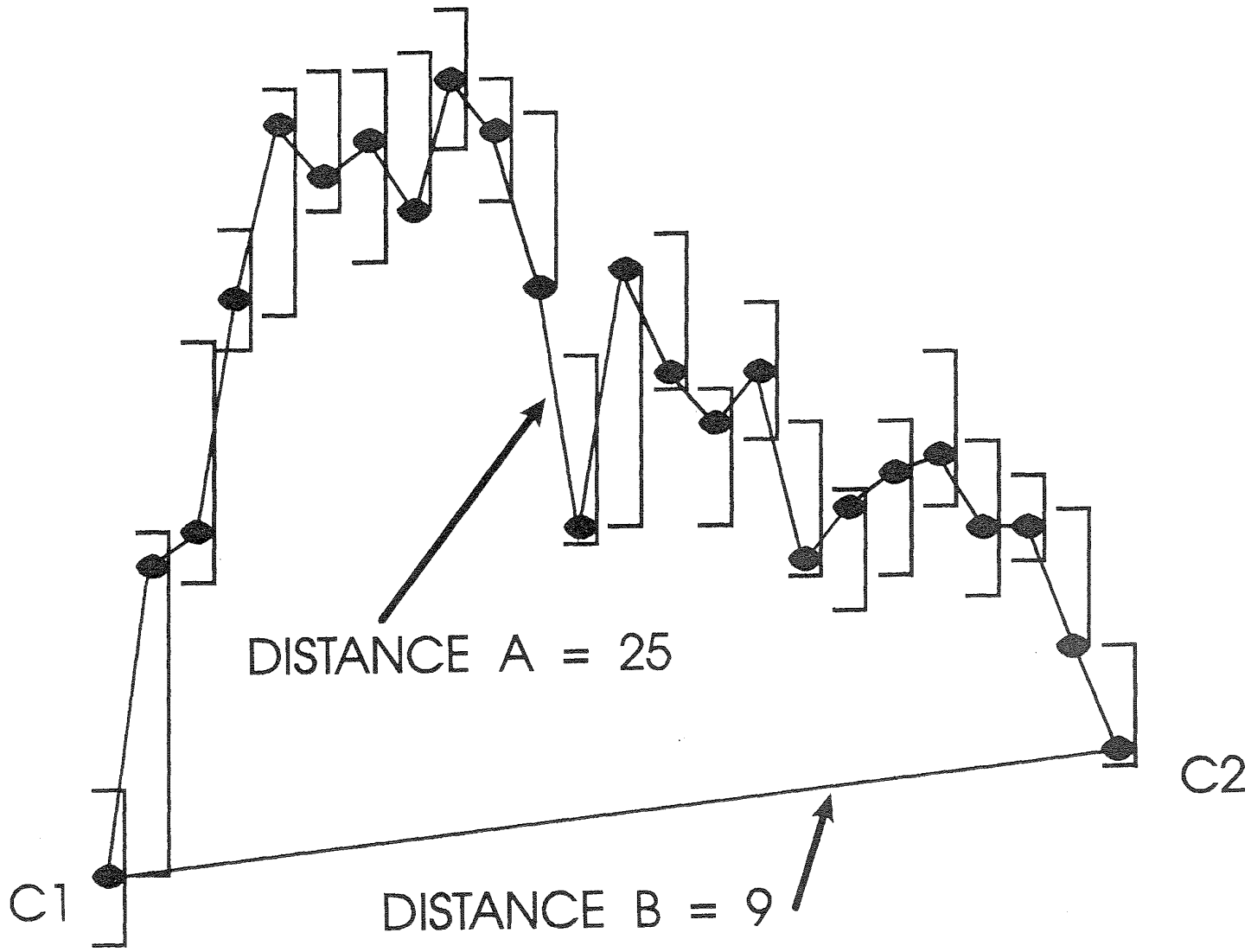


$$P.F.E. = 1/D$$

percentage value of efficiency

WHERE D IS THE FRACTAL DIMENSION

PFE IS + IF B > A OR IS - IF A>B

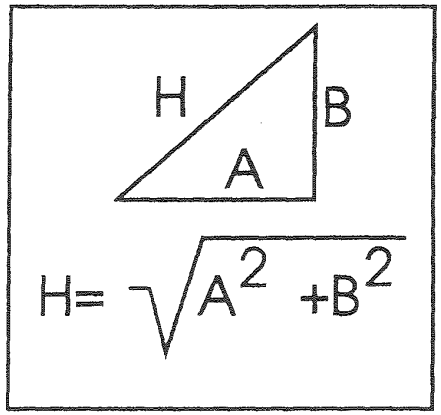


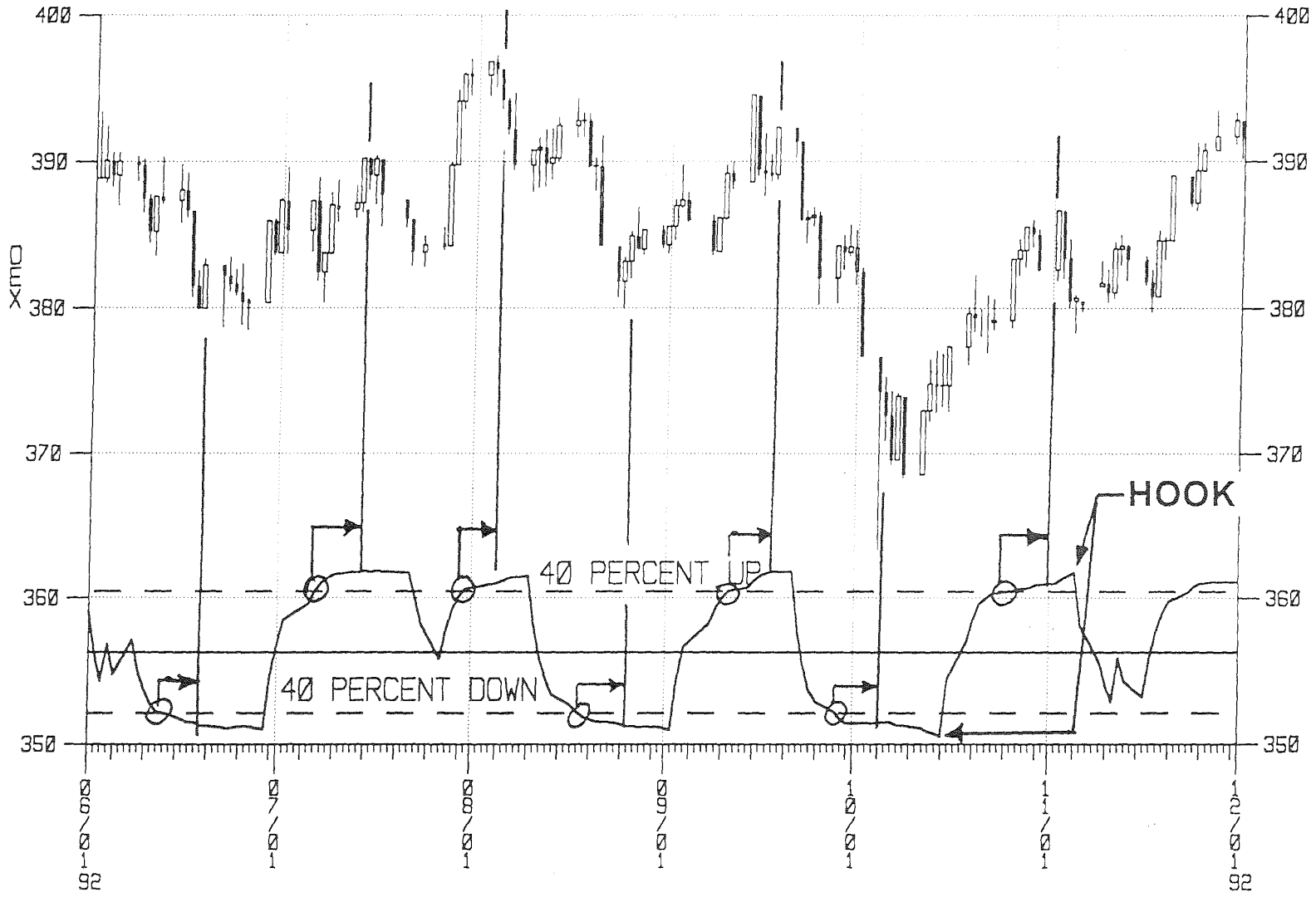
IGNORING LOGS, EFFICIENCY = 9/25 = 36%

$$PFE = SIGN \frac{\sqrt{\left(CLOSE_n - CLOSE_1\right)^2 + n^2}}{\sum_{i=2}^{n} \sqrt{\left(CLOSE_i - CLOSE_{i-1}\right)^2 + 1}}$$

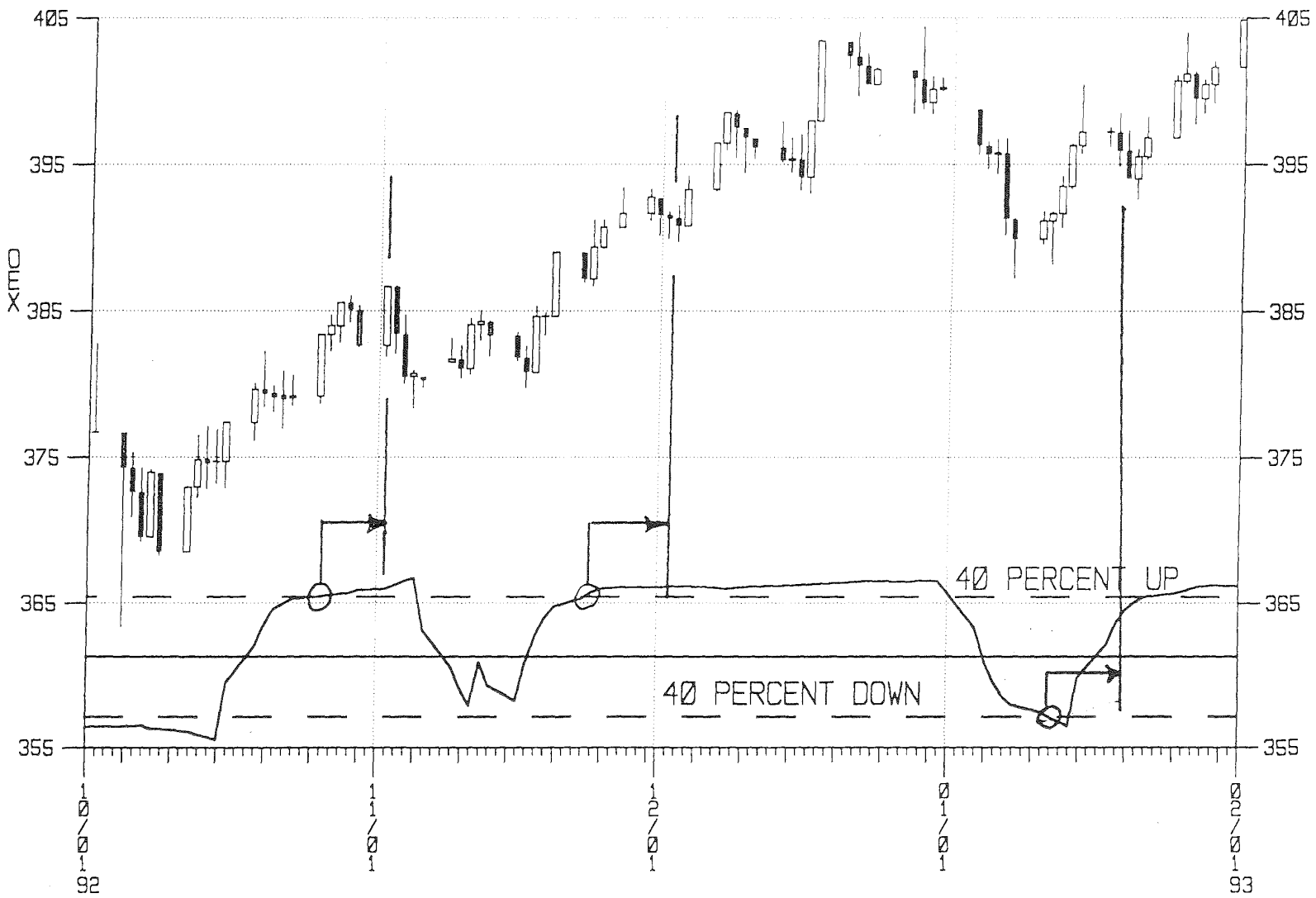
WHERE
SIGN IS PLUS IF $CLOSE_n$
IS HIGHER THAN $CLOSE_1$

AND MINUS IF $CLOSE_n$
IS LOWER THAN $CLOSE_1$





OEX AND 10 DAY POLARIZED FRACTAL EFFICIENCY



OEX AND 10 DAY POLARIZED FRACTAL EFFICIENCY

LISTING OF C PROGRAM TO COMPUTE PFE

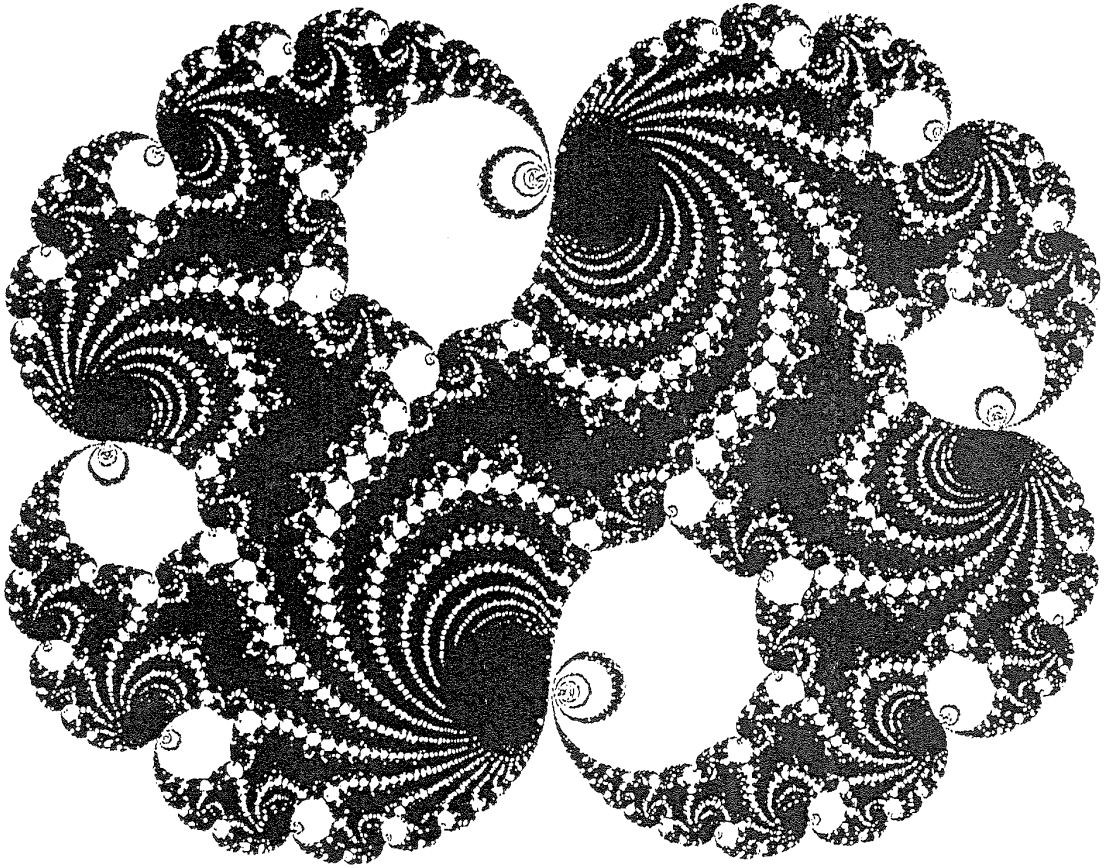
```
#include <stdio.h>
#include <math.h>
double sqrt();
double log();
#define SIZE 4000
#define debug 1
/* rename as ebug to turn on prints */
#define PI 3.1415926535
int month[SIZE],day[SIZE],year[SIZE];
double data[SIZE];
double volume,high,low;
main(argc,argv)
int argc;
char *argv[];
{
double ave;
double avedate;
int npts;
int nread;
int start,end; /* starting and ending indexes */
int mid; /* mid index */
int i,j;
FILE *fp,*fpout,*fopen();
int done;
double A,B,C,D,E,F;
double lastave;
double diff;
   if (argc < 4) /* no args; error and quit */
   {
            printf ("\n usage: fracdimh filein fileout number_of_points\ndata in .hlc format\n");
            exit(1);
   }
```

```
    else
    if ((fp = fopen(argv[1], "r")) == NULL) {
                fprintf(stderr,
                        "fracdimh: can't open %s\n", argv[1]);
                exit(1);
    }
    if ((fpout = fopen(argv[2], "w")) == NULL) {
          fprintf(stderr,
          "fracdimh: can't open %s\n", argv[1]);
          exit(1);
    }
npts=atoi(argv[3]);
#ifdef ebug
printf("\n npts= %d",npts);
#endif
/* fill initial array */
     for(i=0;i<npts;i++){
       done=fscanf(fp,"%d%d%d%lf%lf%lf%lf",&month[i],&day[i],&year[i],&volume,&high,&low,&data[i]);
         if(done<7)exit(1);
#ifdef ebug
printf("\n date[%d] = %2d %2d %4d , data[%d]= %f",i,month[i],day[i],year[i],i,data[i]);
#endif
     }
     /* set up initial indexes */
     start=0;
     end= npts-1;
     while(1){
    /* compute the straight line distance */
                A=sqrt( end*end + (data[end]-data[start])*(data[end]-data[start]) );
                /* now compute crooked distance */
                B=0;
                for(i=start;i<end;i++)
                {
                        D=data[i+1]-data[i];
```

```
                        B=B+sqrt( 1.0 + D*D );
#ifdef ebug
printf("\n i=%d data[i+1]=%lf data[i]=%lf D=%lf B=%lf", i, data[i+1],data[i],D,B);
#endif
                }
                /* compute the normalized fractal dimension */
                C=A/B;
                D=1.0 + ( ( log(B) -log(A) ) / log ( (double) (npts) ) );
                if(data[end] < data[start]) D= -D ;
#ifdef ebug
printf("\n A= %lf",A);
printf("\n B= %lf",B);
printf("\n C= %lf",C);
printf("\n D= %lf",D);
#endif
    fprintf(fpout,"\n%2d %2d %4d %9.3lf",month[end],day[end],year[end], D);
    /* now push the data down */
                for(i=start;i<end;i++)
                {
                        data[i]=data[i+1];
                        month[i]=month[i+1];
                        day[i]=day[i+1];
                        year[i]=year[i+1];
                }
    /* now add the new point  */
      done=fscanf(fp,"%d%d%d%lf%lf%lf%lf",&month[end],&day[end],&year[end],&volume,&high,&low,&data[end]);
         if(done<7)exit(1);
                lastave=ave;
    }
}
```

Fractal Patterns

FRACTAL PATTERNS ARE GENERATED BY ITERATED FUNCTIONS



from p. 191, THE FRACTAL GEOMETRY OF NATURE, Madelbrot

GENERATING A FRACTAL SET BY ALGEBRAIC ITERATED FUNCTIONS

$f(n) = X_{n+1} = A\ X_n\ (1-X_n)$ for X between 0 and 1

starting with X = 1.5 and using A= .5 (step 0)

step 1: $X_1 = .5 \times 1.5 \times (1-1.5) = .5 \times 1.5 \times (-.5) = -.375$

step 2: $X_2 = .5 \times (-.375) \times (1 - - .375) = -(.5 \times .375 \times 1.35) = \_\_\_$

1.375

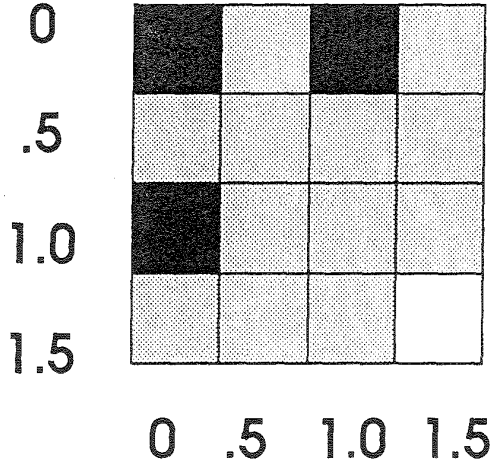
step 3: etc.

This sequence of numbers is called the "orbit" of the function. This orbit ends up at different places depending on the starting value.

What happens if we start at X=1.0? X greater than 1? X less than 1?

HOW TO CREATE THOSE MAGIC FRACTAL PICTURES

1. USE TWO INTERATED FUNCTIONS
   ONE FOR HORIZONTAL (X) AND
   ONE FOR VERTICAL (Y)
2. DIVIDE SURFACE INTO AN X-Y GRID OF STARTING VALUES
3. COMPUTE ORBITS FOR EACH GRID SQUARE
4. COLOR GRID ACCORDING TO SOME FINAL VALUE RULES



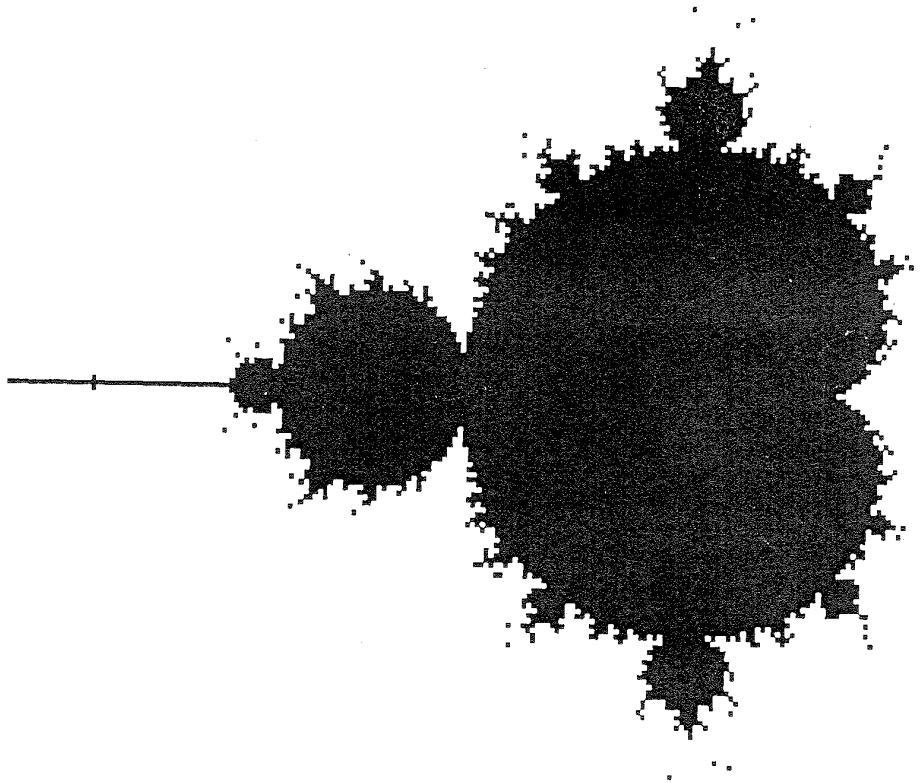
USING EXAMPLE FUNCTION,
WITH A=2 FOR X AND Y DIRECTIONS

AND RULES
BOTH X AND Y-> 0 , BLACK
BOTH X ANY Y -> +/- BIG, WHITE
OTHERWISE GREY

0.0 -> 0
.5 -> .5
1.0 -> 0
1.5 -> -BIG

5. NAME IT AFTER YOURSELF, CALL IT A SET, AND BECOME FAMOUS

A MANDELBROT SET CREATED THIS WAY

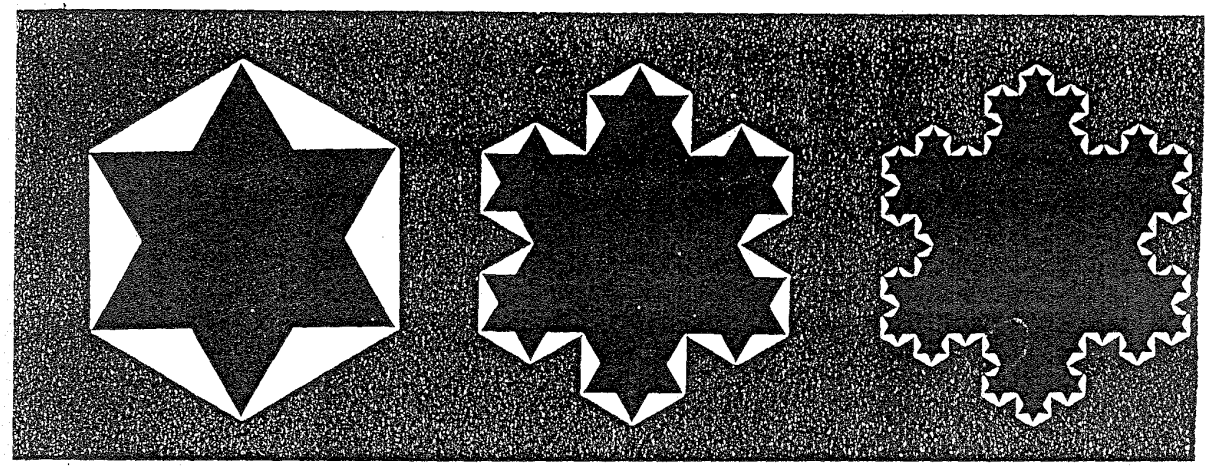


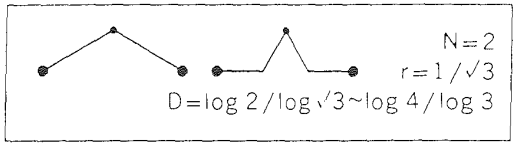
BASIC PROGRAM, p. 117

```
REM program MANDELBROT1
CLS
FOR i=1 TO 300
  FOR j=1 TO 150
     c1= -2+4*i/300
     c2 = 2-4*j/300
     x=c1
     y=c2
       FOR n=1 TO 30
           x1=x*x-y*y+c1
           y1=2*x*y+c2
           r=x1*x1+y1*y1
           IF r>4 THEN GOTO 1000
           x=x1
           y=y1
           NEXT n
        PSET(i,j)
       PSET(i,300-j)
  1000 NEXT j
NEXT i
END
```

after Devaney, CHAOS, FRACTALS, AND DYNAMICS, COMPUTER EXPERIMENTS IN MATHMATICS, p. 115

GENERATING A FRACTAL SET GEOMETRICALLY





INITIATOR GENERATOR

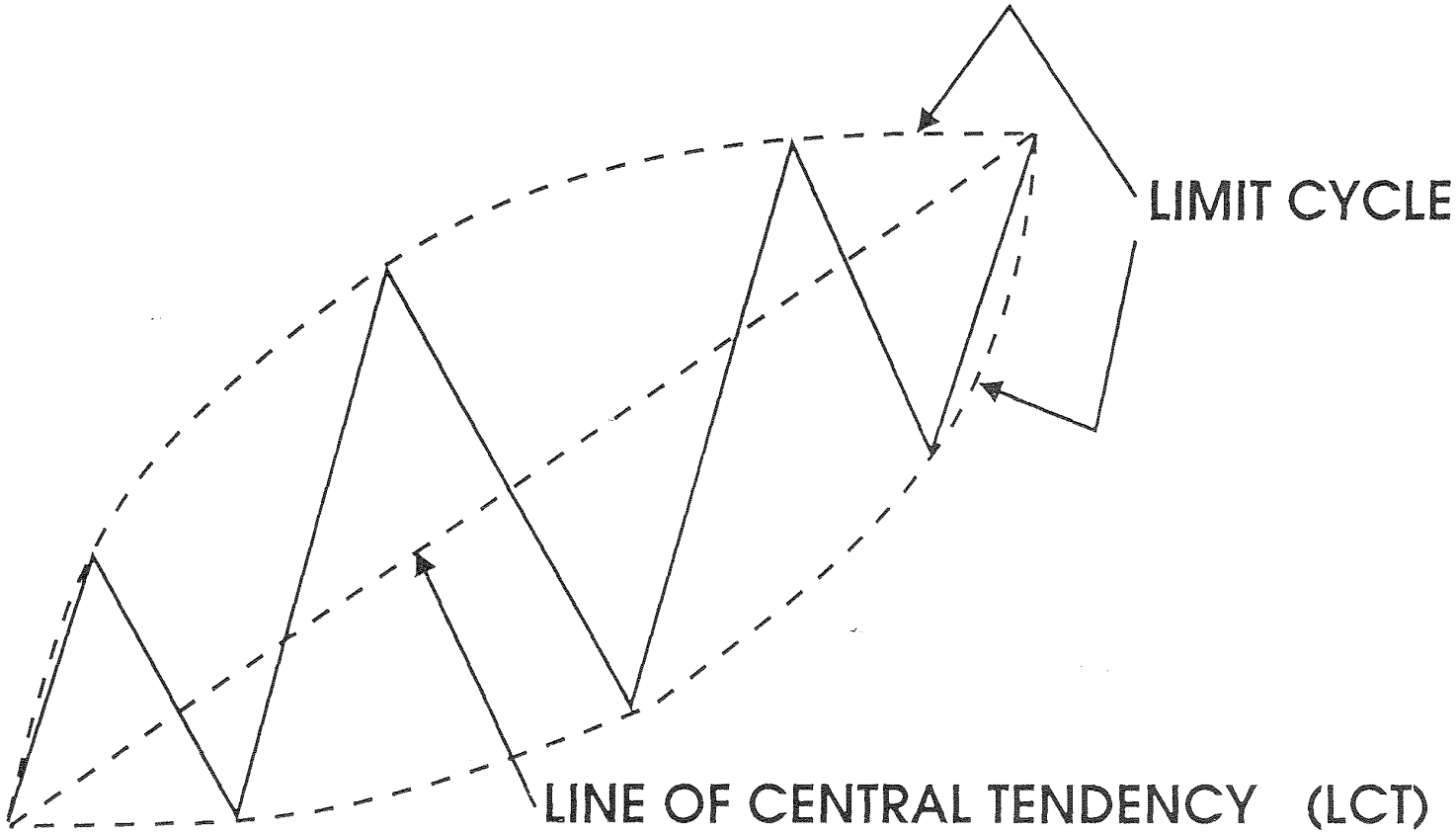
Plate 43 □ TRIADIC KOCH ISLAND OR SNOWFLAKE *K*. ALTERNATIVE CONSTRUCTION BY ERNEST CESÀRO (COASTLINE DIMENSION D=log 4/log 3~1.2618)

1. TAKE INITIATOR
2. REPLACE EACH LINE SEGMENT IN PATTERN BY GENERATOR, SCALING AS NEEDED
3. REPEAT 2 FOR n STEPS

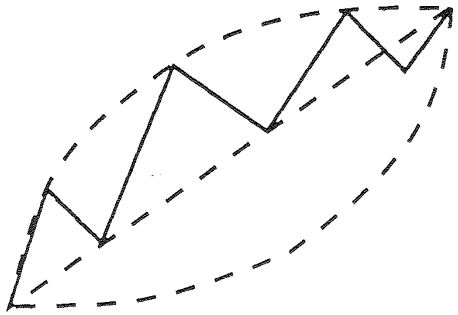
after Mandelbrot, THE FRACTAL GEOMETRY OF NATURE, p. 43

The Hannula Market Fractal

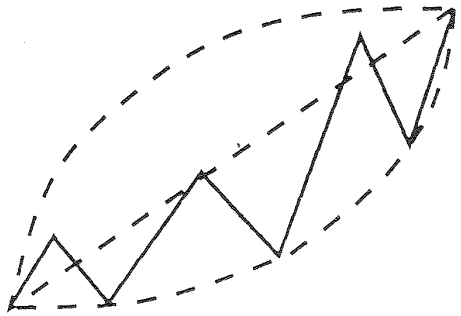
THE HANNULA MARKET FRACTAL SET



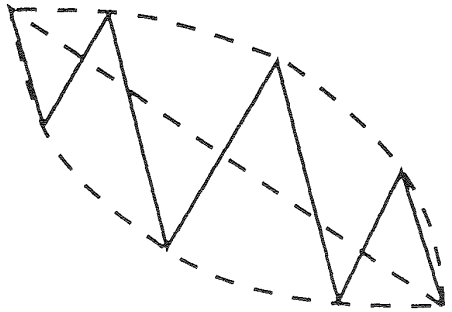
VARIATIONS OF THE HANNULA MARKET FRACTAL SET



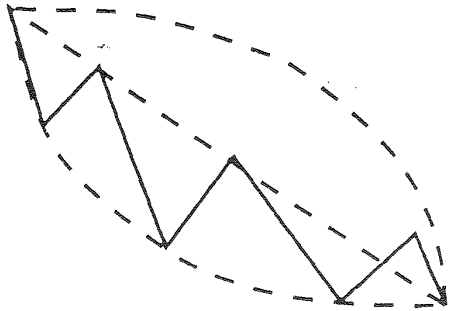
UP TOP



UP BOTTOM



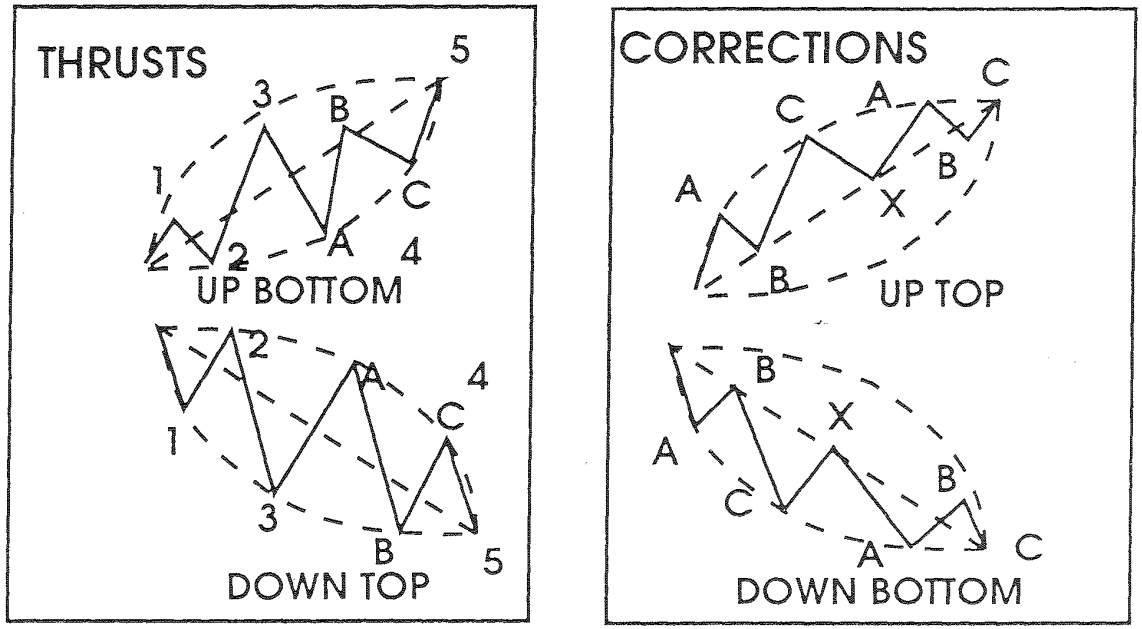
DOWN TOP



DOWN BOTTOM

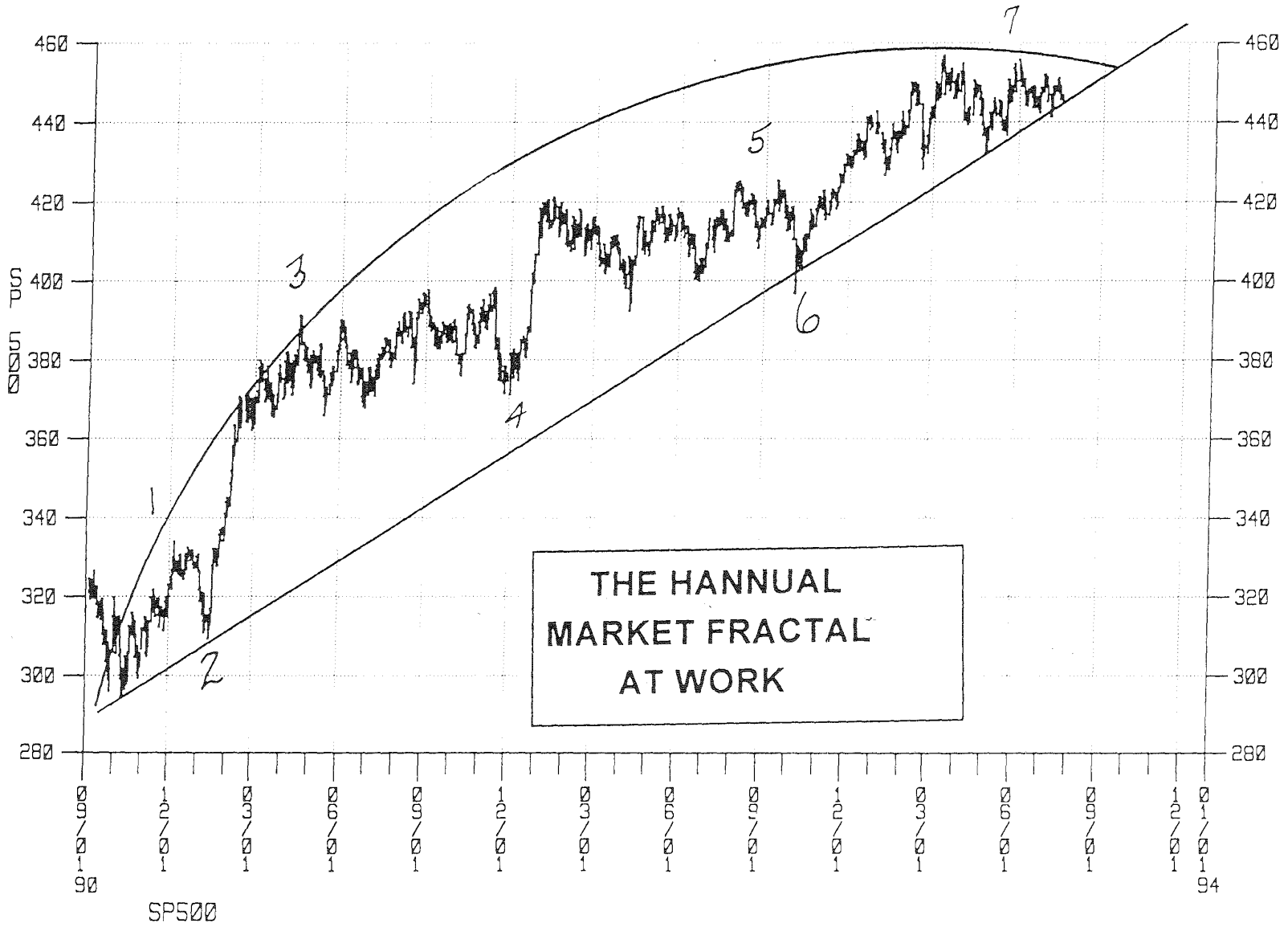
THE HANNULA MARKET FRACTAL SET

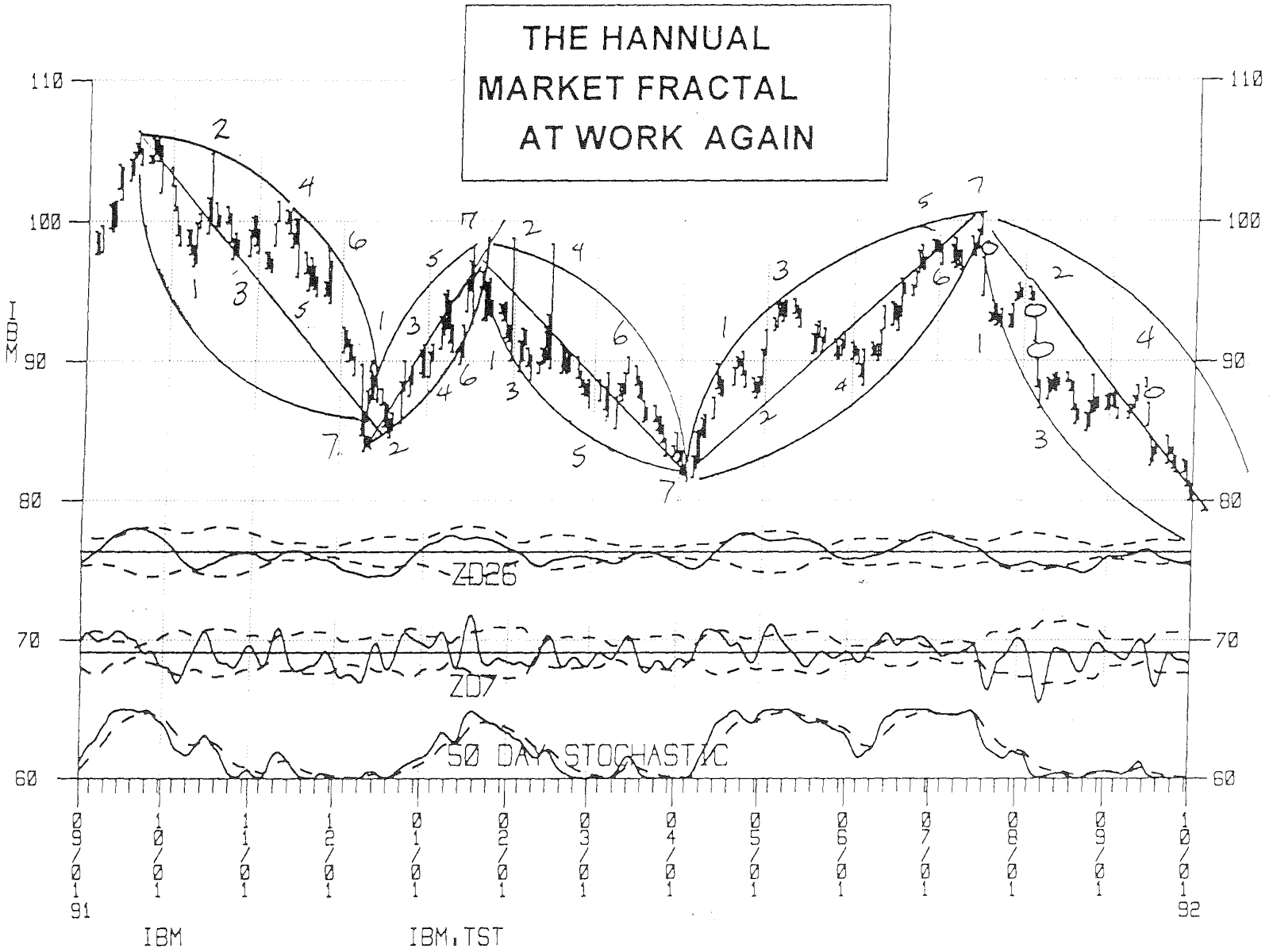
1. UNDERLIES ALL MARKET MOVES
2. WORKS ON ANY TIME SCALE
3. IS BASED ON THE PHYSICS OF NATURAL CYCLES
4. IS ONE PATTERN, UP OR DOWN, OF 7 ARGUABLE MOVES
5. UNDERLIES ELLIOTT WAVES

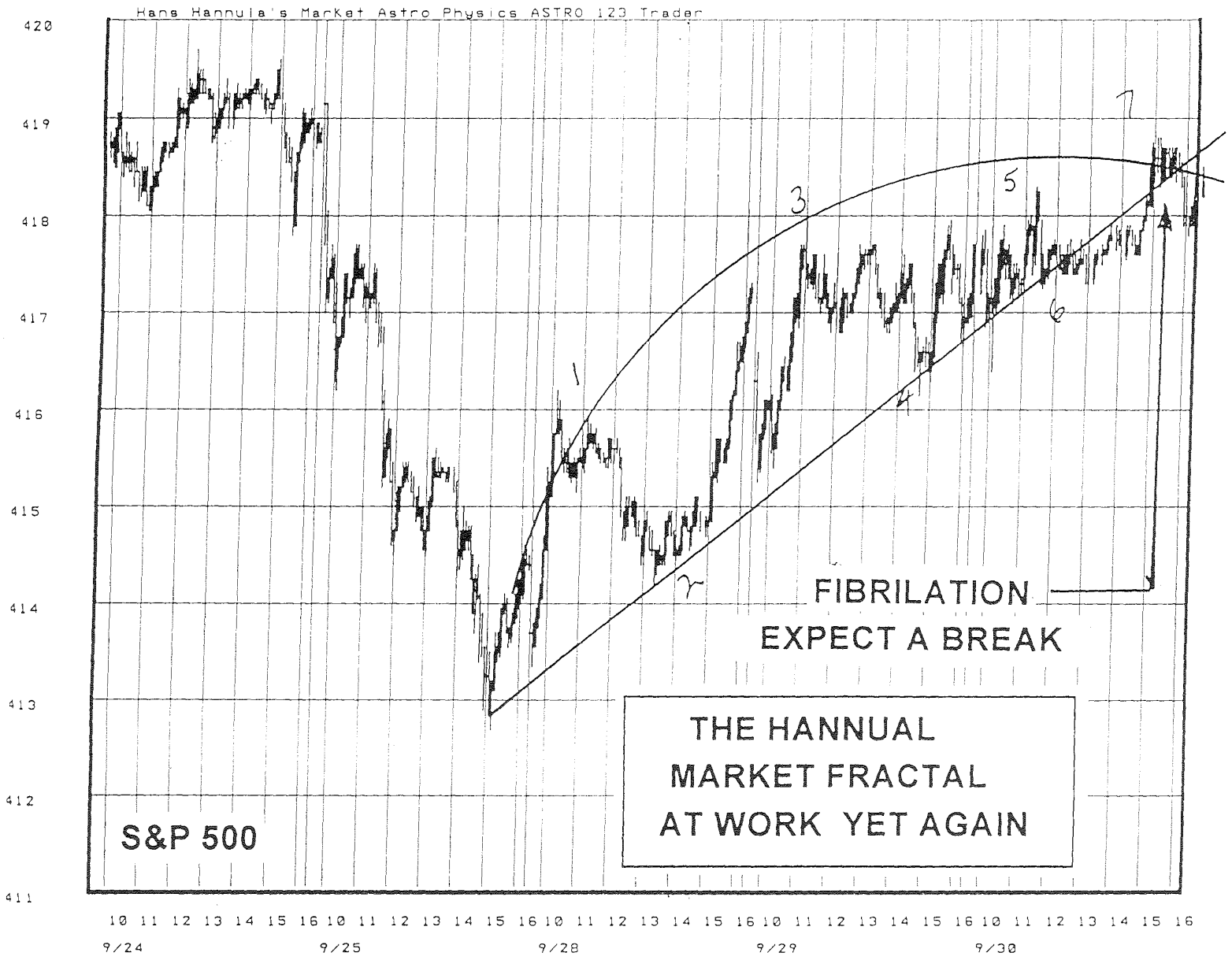


SIMPLIFY !

1. FIND LIMIT CYCLES
2. FIND LCT
3. LOOK FOR 7 MOVES


THE HANNUAL
MARKET FRACTAL
AT WORK
SP500
460
440
420
400
380
360
340
320
300
280
1
2
3
4
5
6
7
09/01/90
12/01/01
03/01/01
06/01/01
09/01/01
12/01/01
03/01/01
06/01/01
09/01/01
12/01/01
03/01/01
06/01/01
09/01/01
12/01/01
01/01/94


THE HANNUAL
MARKET FRACTAL
AT WORK AGAIN
110
100
90
80
70
60
IBM
ZD26
ZD7
50 DAY STOCHASTIC
09/01/91
10/01/91
11/01/91
12/01/91
01/01/92
02/01/92
03/01/92
04/01/92
05/01/92
06/01/92
07/01/92
08/01/92
09/01/92
10/01/92
IBM
IBM.TST

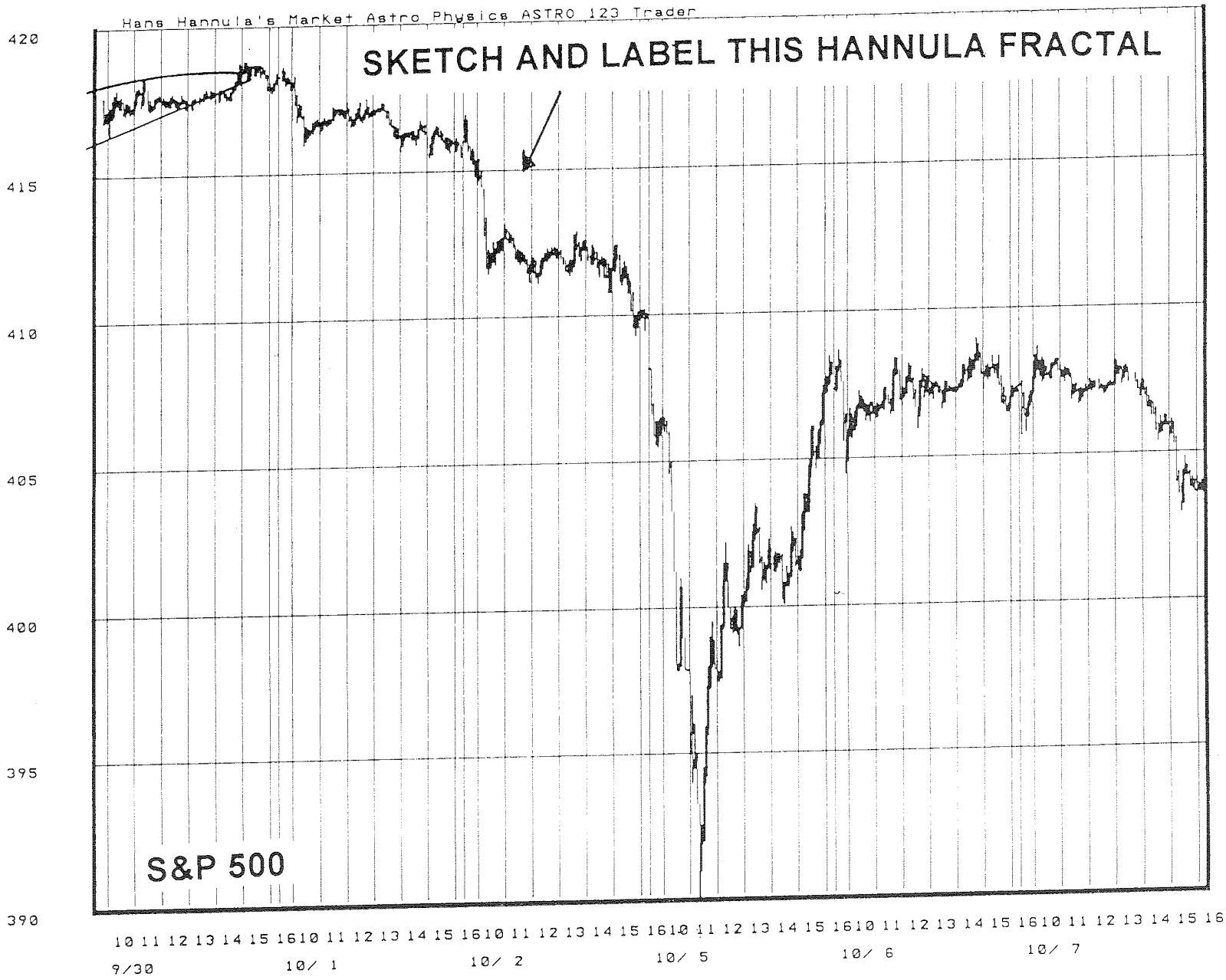

Hans Hannula's Market Astro Physics ASTRO 123 Trader
420
419
418
417
416
415
414
413
412
411
1
2
3
5
6
7
FIBRILATION
EXPECT A BREAK
THE HANNUAL
MARKET FRACTAL
AT WORK YET AGAIN
S&P 500
10 11 12 13 14 15 16 10 11 12 13 14 15 16 10 11 12 13 14 15 16 10 11 12 13 14 15 16 10 11 12 13 14 15 16
9/24
9/25
9/28
9/29
9/30

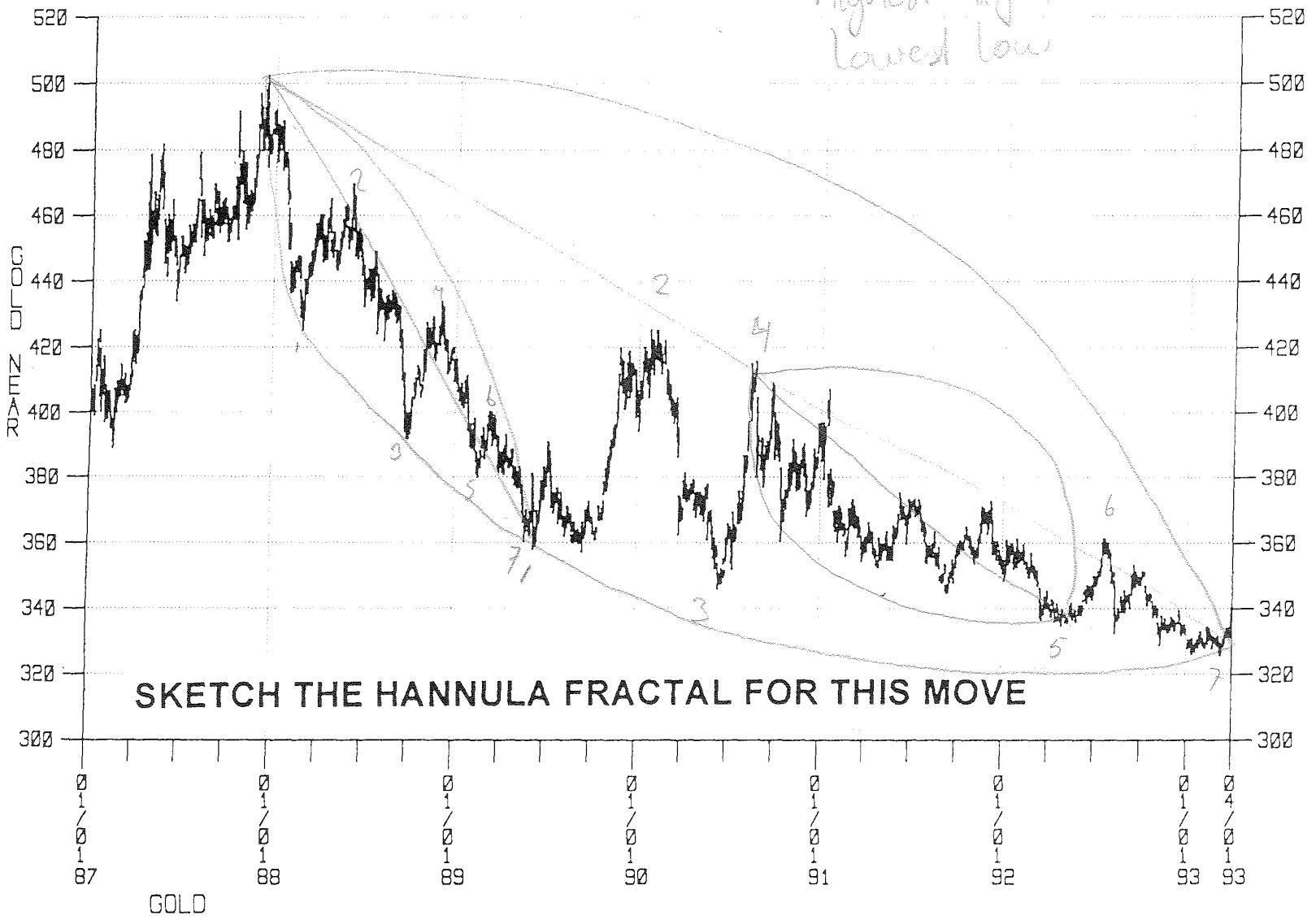

Hans Hannula's Market Astro Physics ASTRO 123 Trader
419
418
417
416
415
414
413
412
411
410
409
HERE'S THE BREAK
FIBRILATION
S&P 500
10 11 12 13 14 15 16 10 11 12 13 14 15 16 10 11 12 13 14 15 16
9/30
10/ 1
10/ 2

THE HANNULA MARKET FRACTAL SET

SKETCHING PROCEDURE

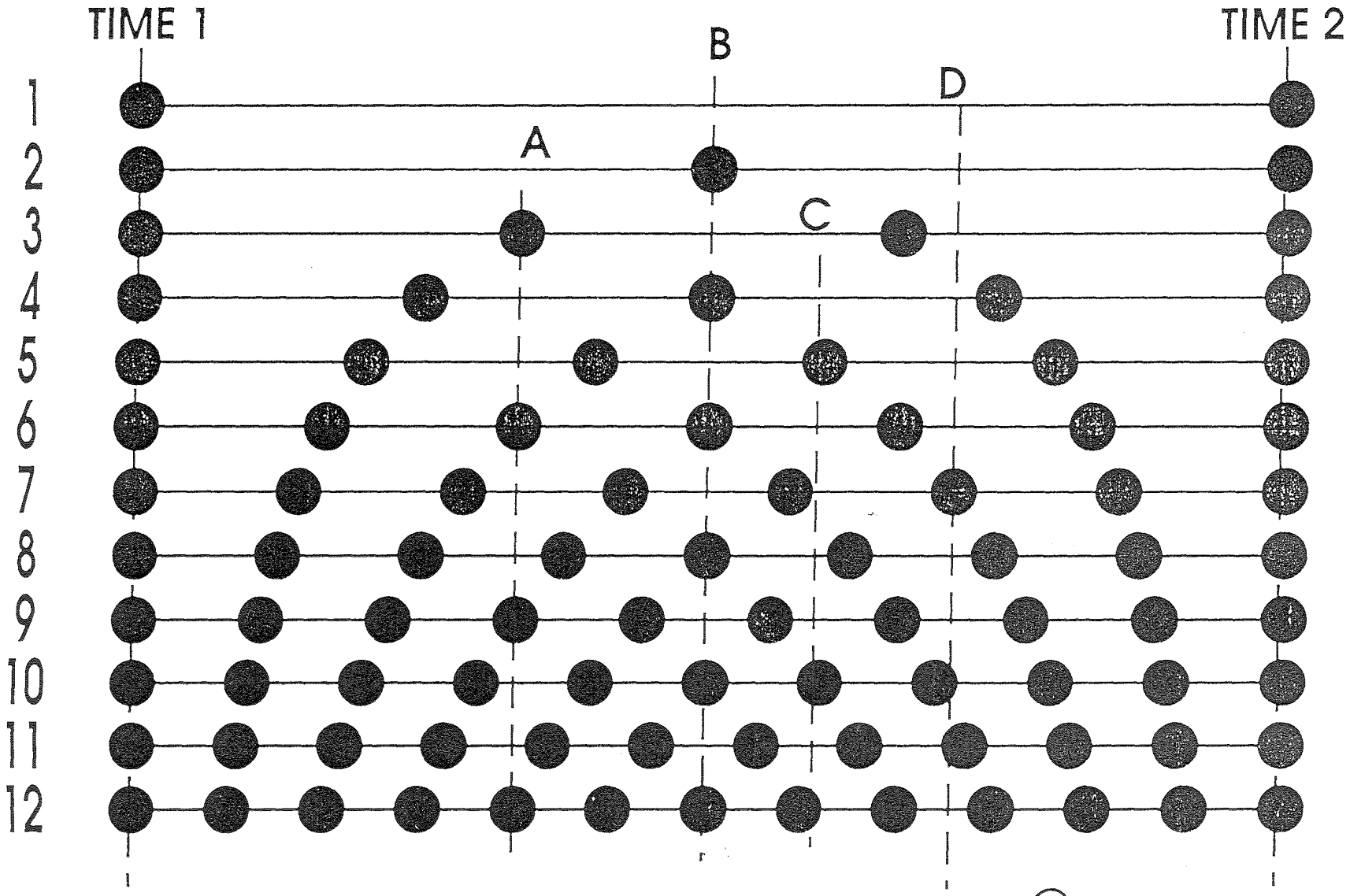
1. CIRCLE HIGHEST HIGH AND LOWEST LOW
2. DRAW LINE BETWEEN THEM AS L. C. T.
3. SKETCH BOTH LIMIT CYCLES
4. DIVIDE "FOOTBALL" IN HALF TO HELP FIND THE 7 MOVES
5. SKETCH IN THE MOVES


Hans Hannula's Market Astro Physics ASTRO 123 Trader
SKETCH AND LABEL THIS HANNULA FRACTAL
S&P 500
420
415
410
405
400
395
390
10 11 12 13 14 15 16 10 11 12 13 14 15 16 10 11 12 13 14 15 16 10 11 12 13 14 15 16 10 11 12 13 14 15 16 10 11 12 13 14 15 16
9/30
10/ 1
10/ 2
10/ 5
10/ 6
10/ 7


highest high
lowest low
520
500
480
460
440
420
400
380
360
340
320
300
DOLLARS
SKETCH THE HANNULA FRACTAL FOR THIS MOVE
01/01/87
01/01/88
01/01/89
01/01/90
01/01/91
01/01/92
01/01/93
04/01/93
GOLD

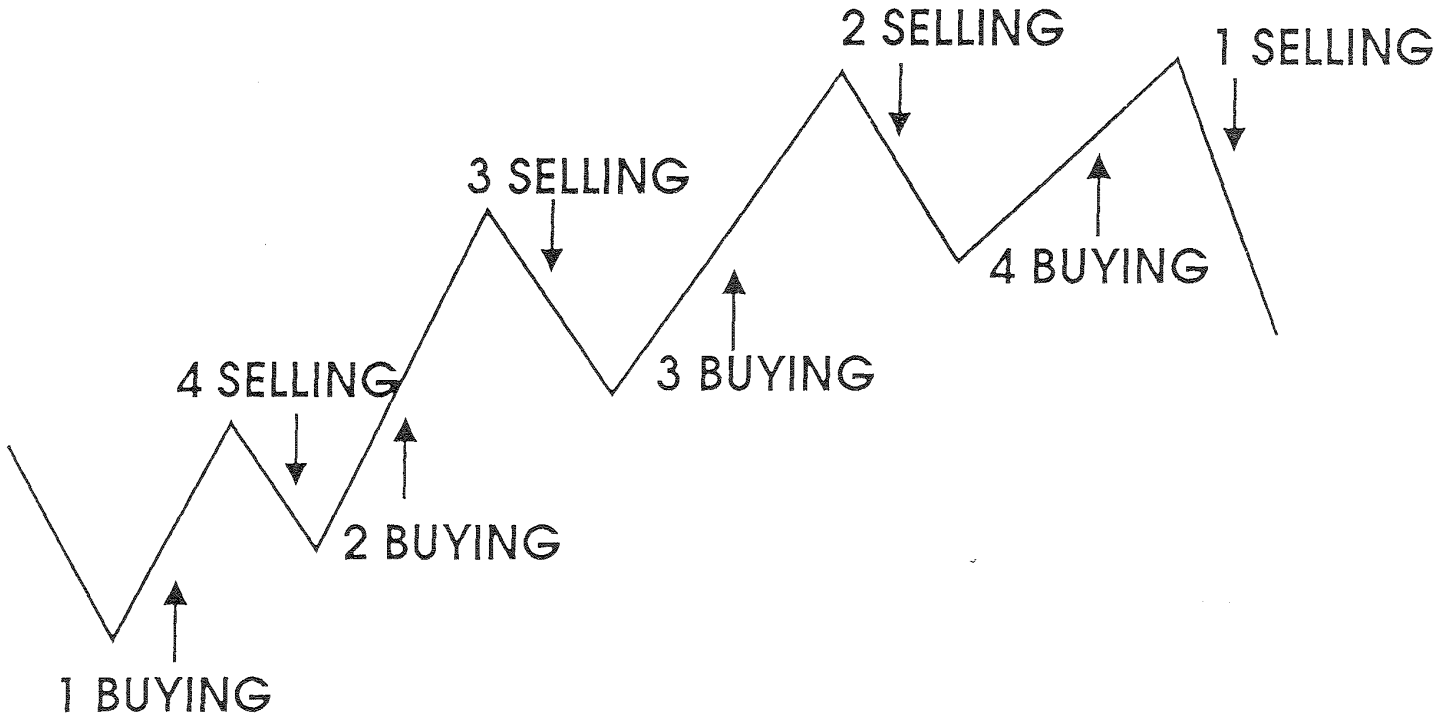

Hans Hannula's Market Astro Physics ASTRO 123 Trader
SKETCH THE HANNULA FRACTAL FOR THIS MOVE
457
456
455
454
453
452
451
450
449
448
447
446
445
444
0
1
2
3
4
5
6
7
1
06/
01
2
06/
02
3
06/
03
4
06/
04
5
06/
07
6
06/
08
7
06/
09
S&P 500 NEAR
DOTODAY1

WHY ARE THERE 7 MOVES?



HARMONIC CYCLES

BUYERS AND SELLERS IN THE FRACTAL



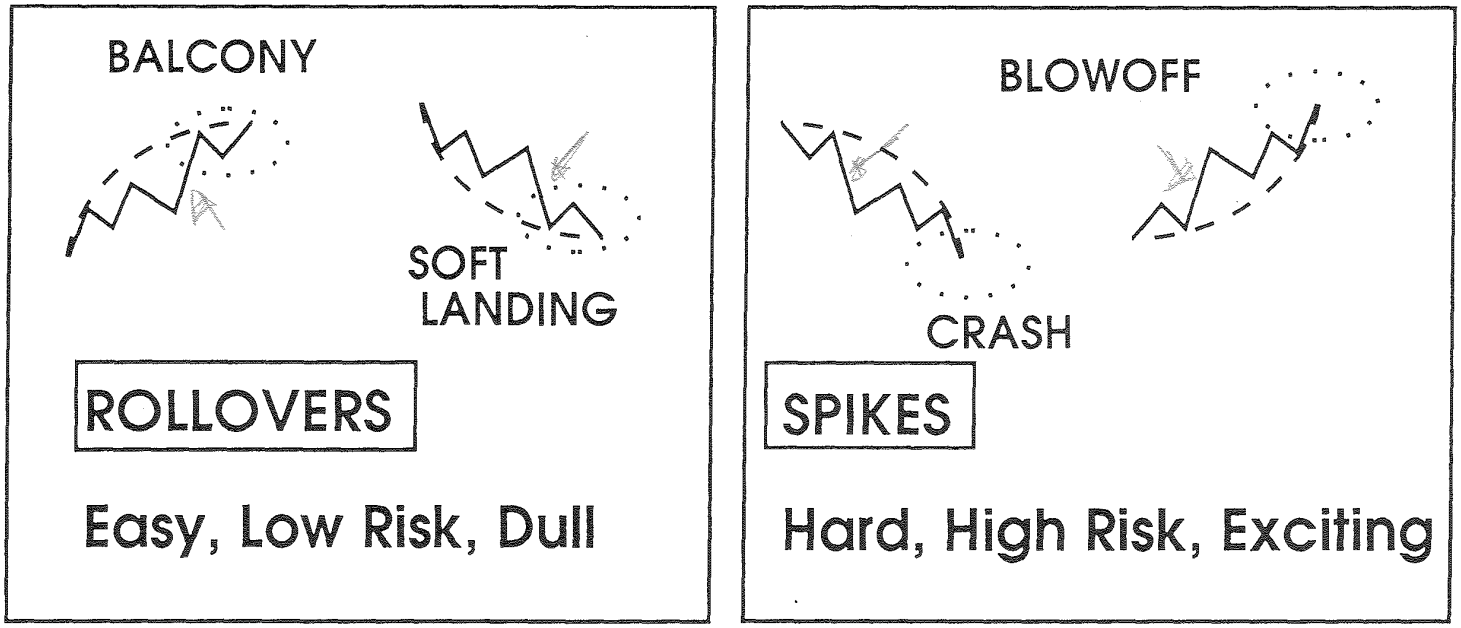
4 GROUPS

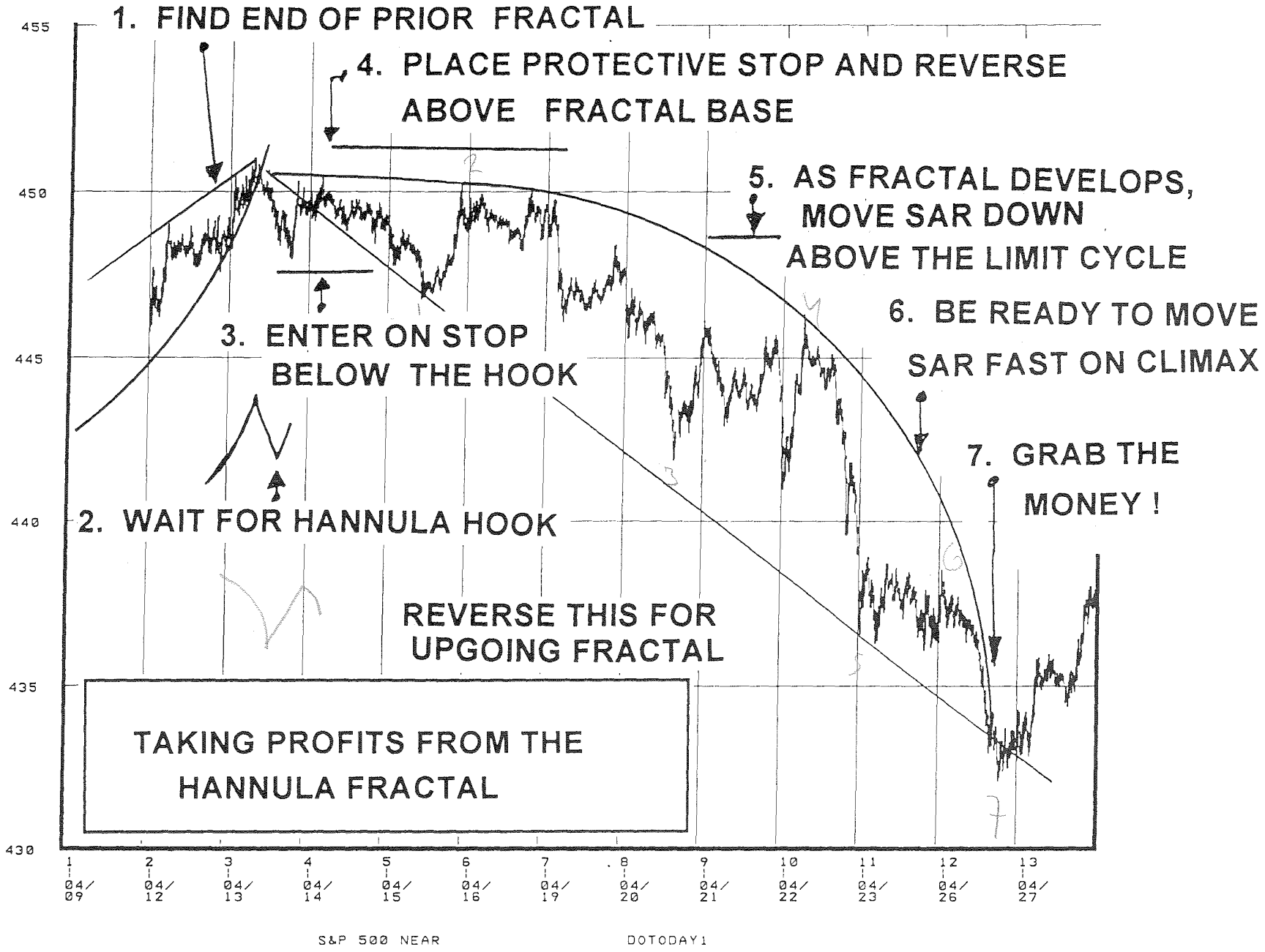
1. REAL PROS - WIN BIG
2. SEMI PROS -WIN SOME
3. SERIOUS AMATUERS - LOSE SOME
4. RANK AMATUERS - LOSE BIG

Trading Examples

THE SECRET OF MAKING MONEY IS

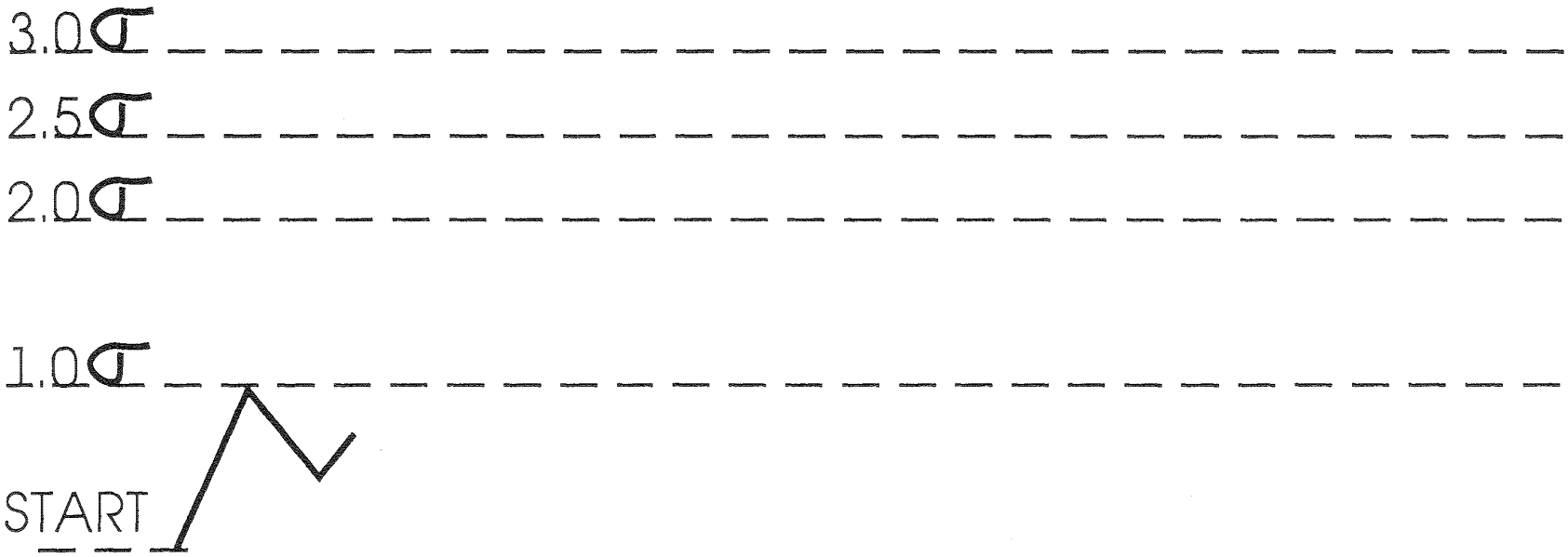
1. KNOWING THAT A FRACTAL HAS BEGUN
2. PROJECTING THE FRACTAL IN ADVANCE
3. UPDATING PROJECTION AS FRACTAL DEVELOPS
4. TRADE EARLY, LATE, OR MIDDLE OF FRACTAL




1. FIND END OF PRIOR FRACTAL
4. PLACE PROTECTIVE STOP AND REVERSE
ABOVE FRACTAL BASE
5. AS FRACTAL DEVELOPS,
MOVE SAR DOWN
ABOVE THE LIMIT CYCLE
6. BE READY TO MOVE
SAR FAST ON CLIMAX
7. GRAB THE
MONEY !
3. ENTER ON STOP
BELOW THE HOOK
2. WAIT FOR HANNULA HOOK
REVERSE THIS FOR
UPGOING FRACTAL
TAKING PROFITS FROM THE
HANNULA FRACTAL
455
450
445
440
435
430
1 04/09
2 04/12
3 04/13
4 04/14
5 04/15
6 04/16
7 04/19
8 04/20
9 04/21
10 04/22
11 04/23
12 04/26
13 04/27
S&P 500 NEAR
DOTODAY1

PROJECTING IN ADVANCE

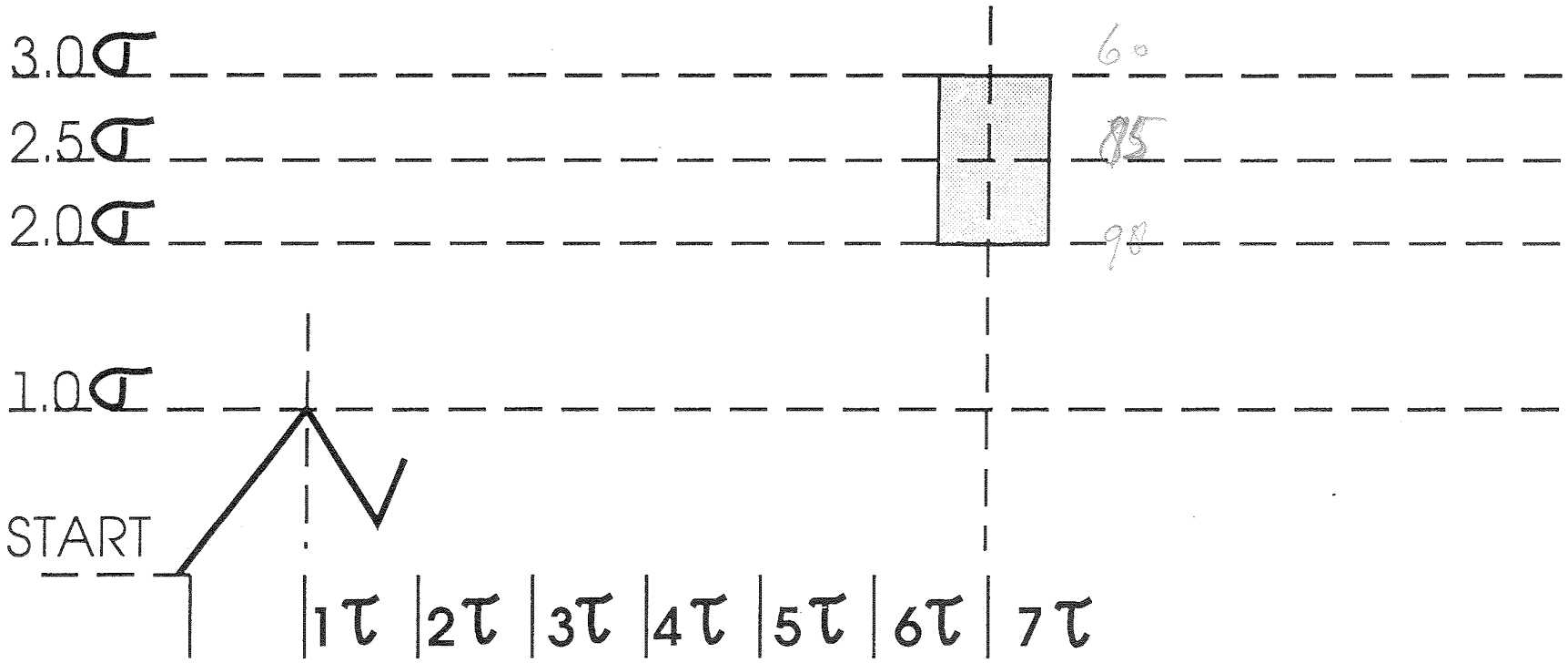
THE HANNULA SIGMA-TAU METHOD



1. FIND A THRUST AND PULLBACK
2. CALL HEIGHT OF THRUST σ (SIGMA)
3. PROJECT UP 2, 2.5, AND 3 SIGMA

PROJECTING IN ADVANCE

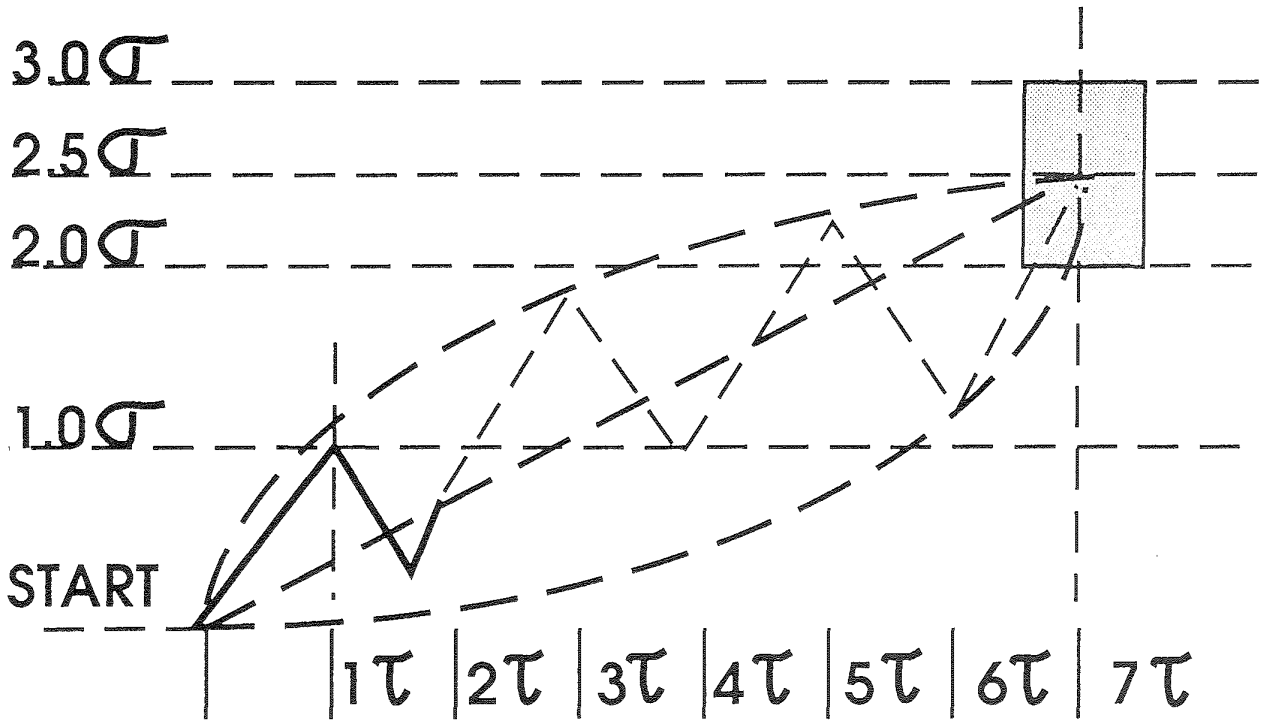
THE HANNULA SIGMA-TAU METHOD



4. ESTIMATE τ (TAU) AS 1/7TH OF THE FRACTAL TIME
   (use risetime of thrust wave initially)
5. PROJECT 7 τ INTERVALS
6. MARK TARGET AT 7 τ, 2.5 σ

PROJECTING IN ADVANCE

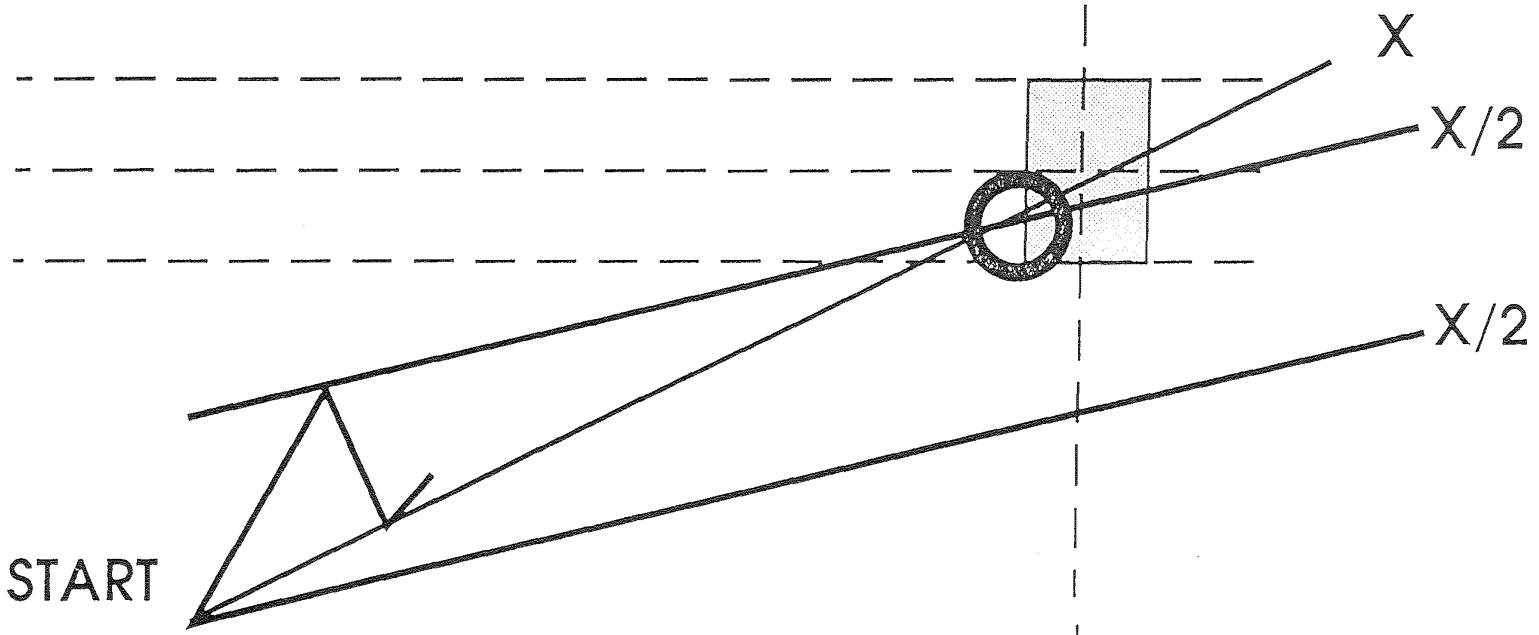
THE HANNULA SIGMA-TAU METHOD



7. DRAW LINE OF CENTRAL TENDENCY
8 . DRAW LIMIT CYCLES
9. SKETCH THE 7 MOVES

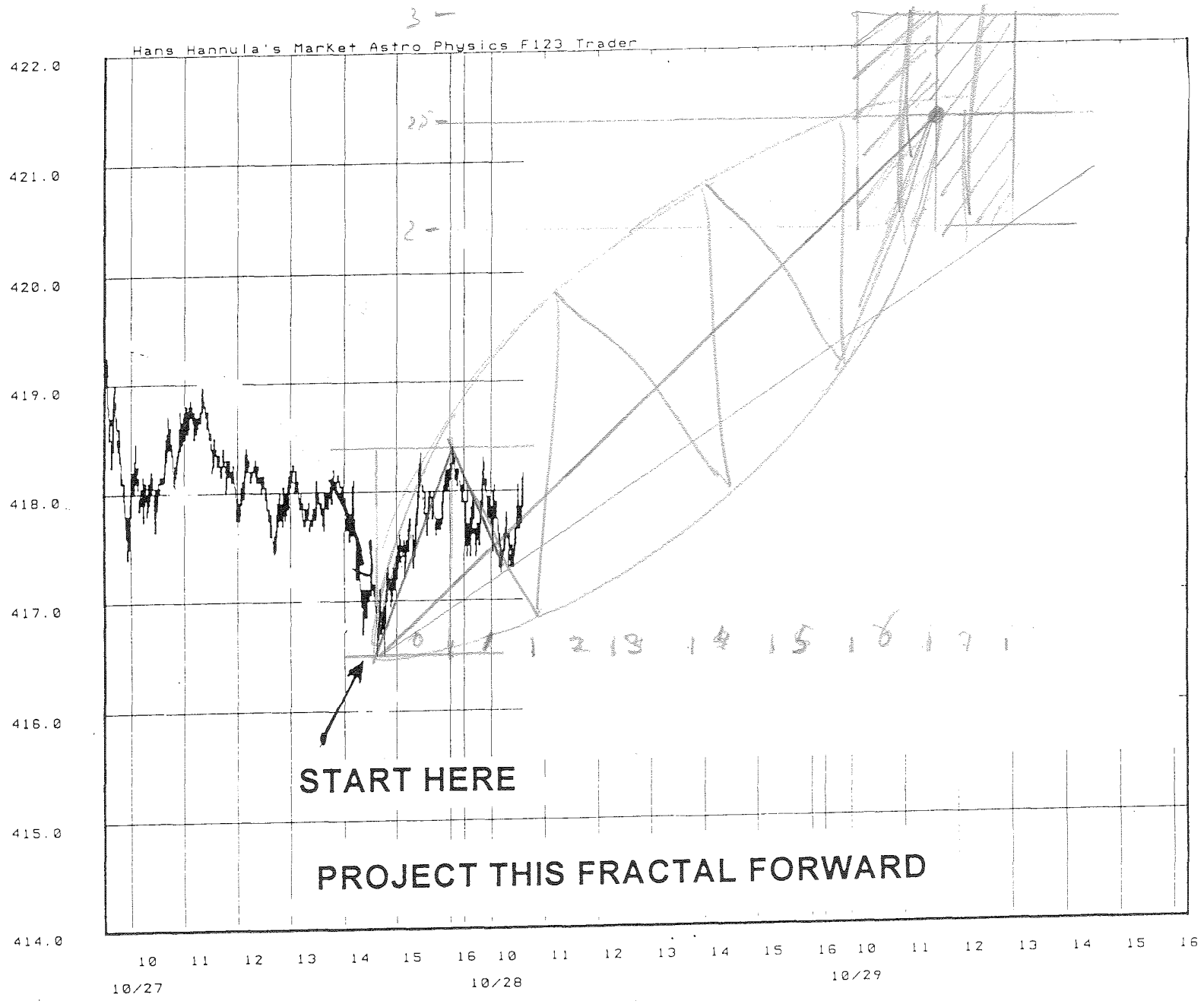
PROJECTING IN ADVANCE

THE HANNULA SIGMA-TAU METHOD



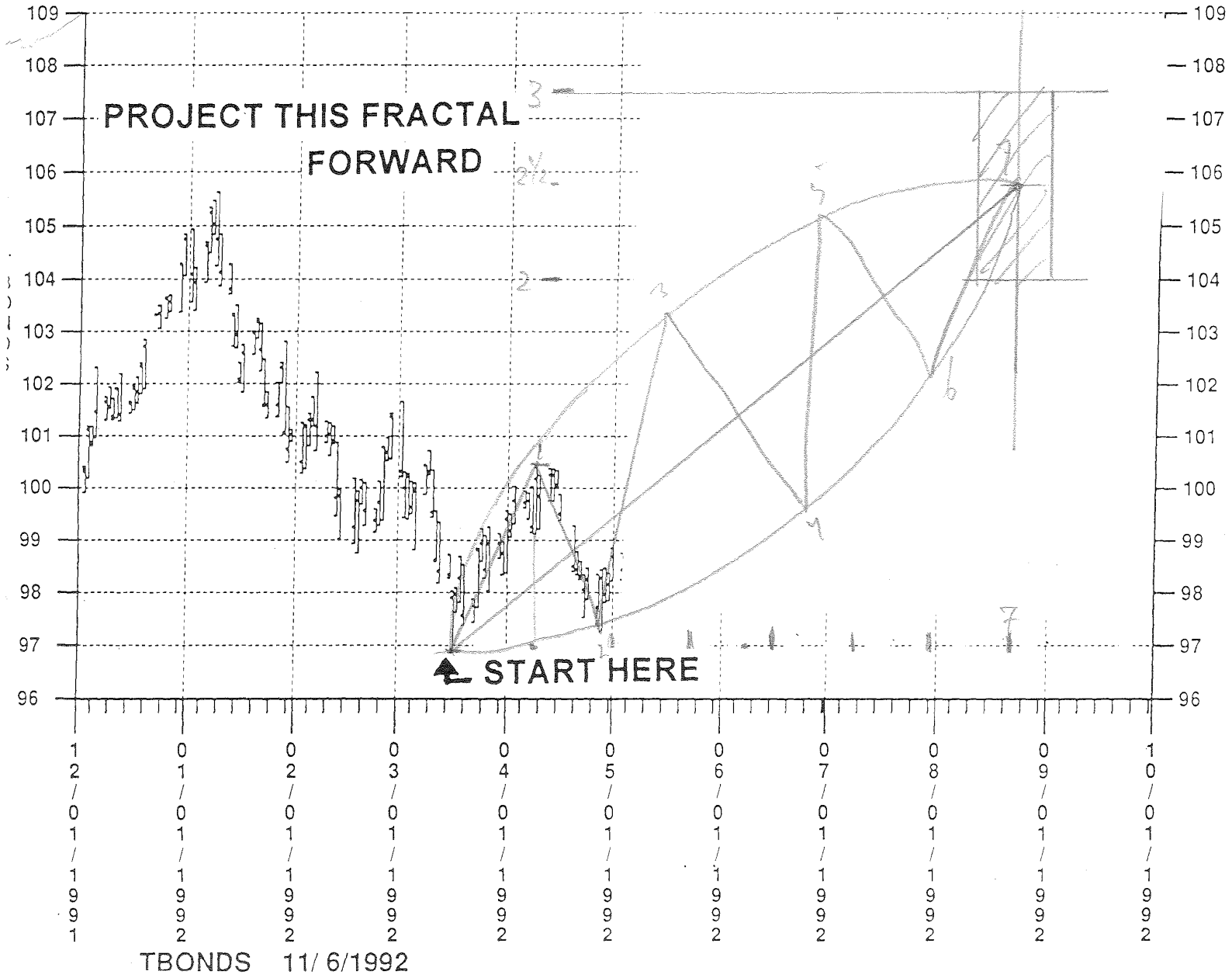
ADD A LINEAR CONFIRMATION BY

10. DRAW SUPPORT LINE X FROM START THROUGH MOVE 2
11. DRAW RESISTANCE LINE WITH HALF THE SLOPE OF X FROM THE TOP OF MOVE 1
12. CROSSING POINT IS USUALLY NEAR TARGET


Hans Hannula's MarKet Astro Physics F123 Trader
422.0
421.0
420.0
419.0
418.0
417.0
416.0
415.0
414.0
START HERE
PROJECT THIS FRACTAL FORWARD
10
11
12
13
14
15
16
10/27
10/28
10/29

F-SEP/DEC S&P


Hans Hannula's Market Astro Physics F123 Trader
422.0
421.0
420.0
419.0
418.0
417.0
416.0
415.0
414.0
START HERE
PROJECT THIS FRACTAL FORWARD
10 11 12 13 14 15 16 10 11 12 13 14 15 16 10 11 12 13 14 15 16
10/27
10/28
10/29


PROJECT THIS FRACTAL
FORWARD
START HERE
109
108
107
106
105
104
103
102
101
100
99
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12/01/1991
01/01/1992
02/01/1992
03/01/1992
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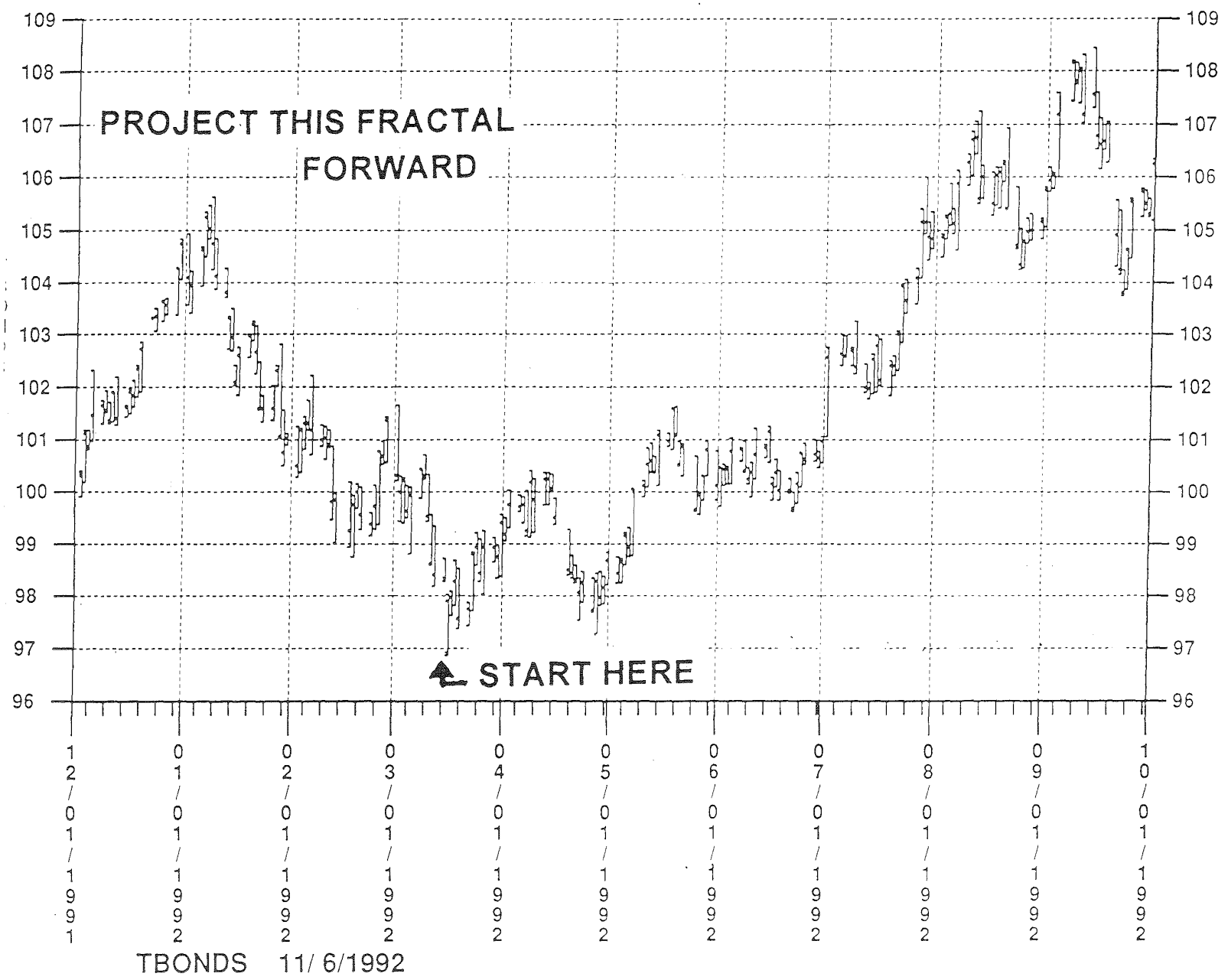
07/01/1992
08/01/1992
09/01/1992
10/01/1992
TBONDS 11/ 6/1992


PROJECT THIS FRACTAL
FORWARD
START HERE
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12/01/1991
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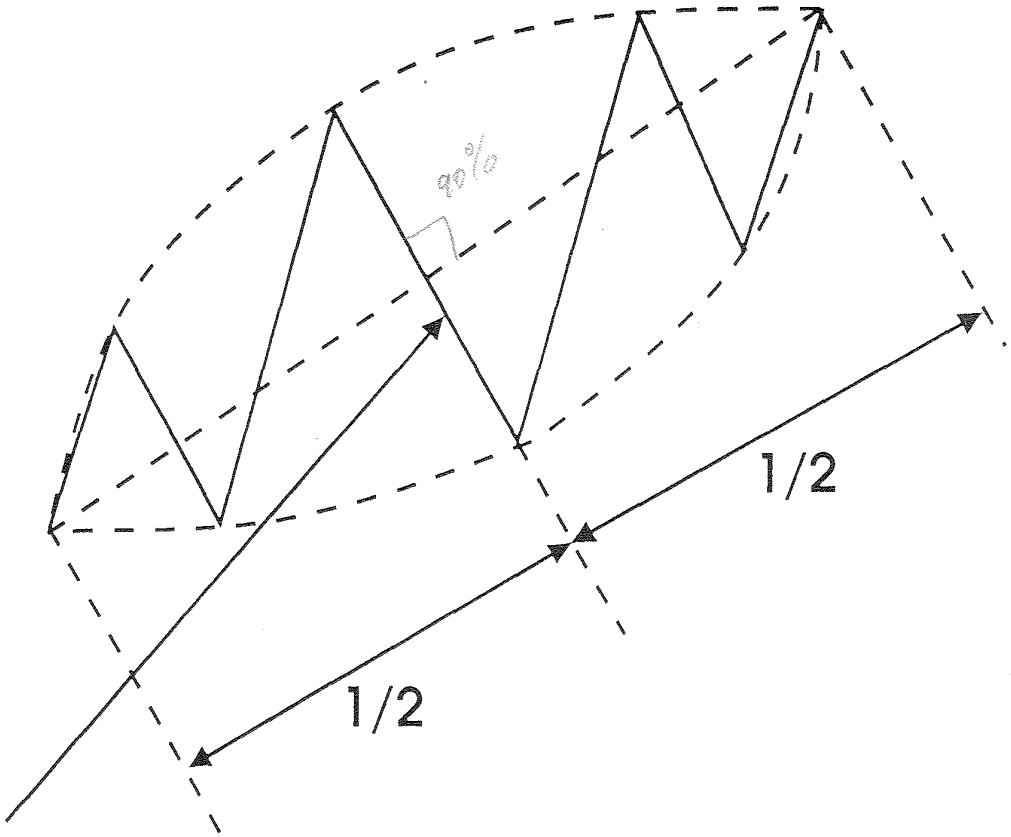
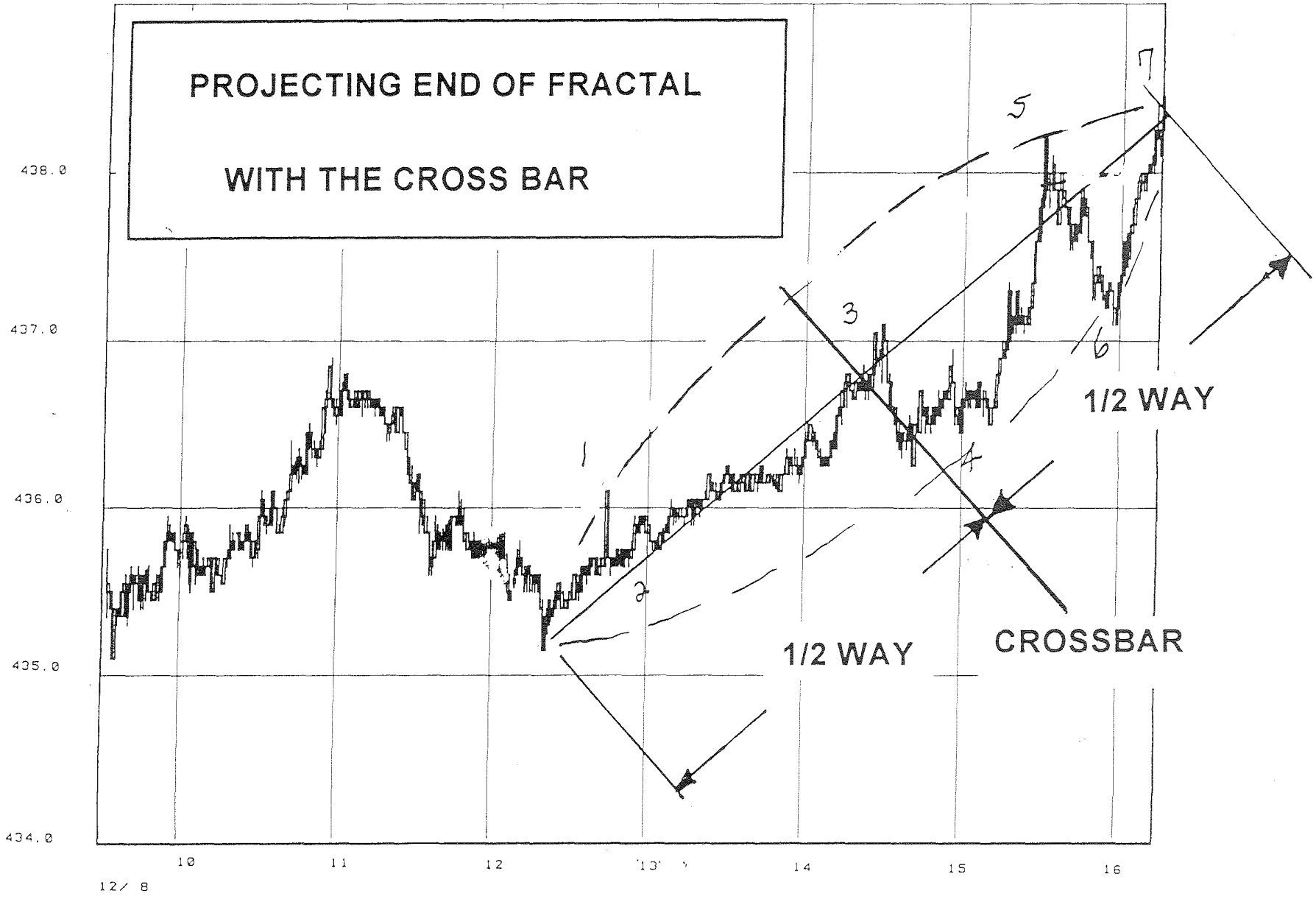
08/01/1992
09/01/1992
10/01/1992
TBONDS 11/ 6/1992

THE CROSSBAR

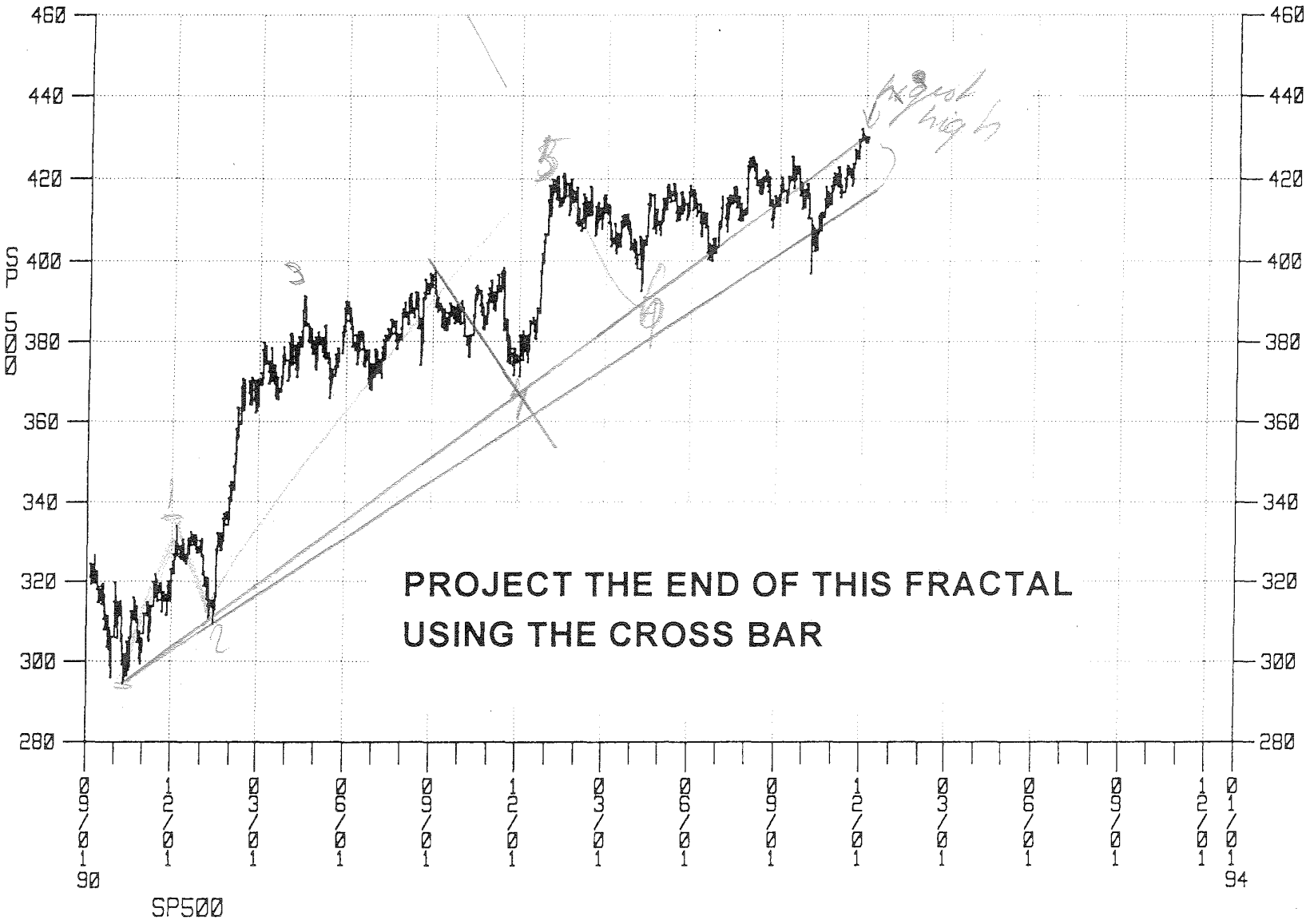


THE CROSSBAR IS THE FOURTH LEG
OF THE HANNULA FRACTAL. IT USUALLY MARKS
THE HALF WAY POINT IN THE MOVE. IT CAN THEREFORE
BE USED TO PROJECT THE END OF THE FRACTAL.



13/08:13:19 F-SEP/DEC S&P LAST = 21:15:19 434.100 434.100 434.100 434.100

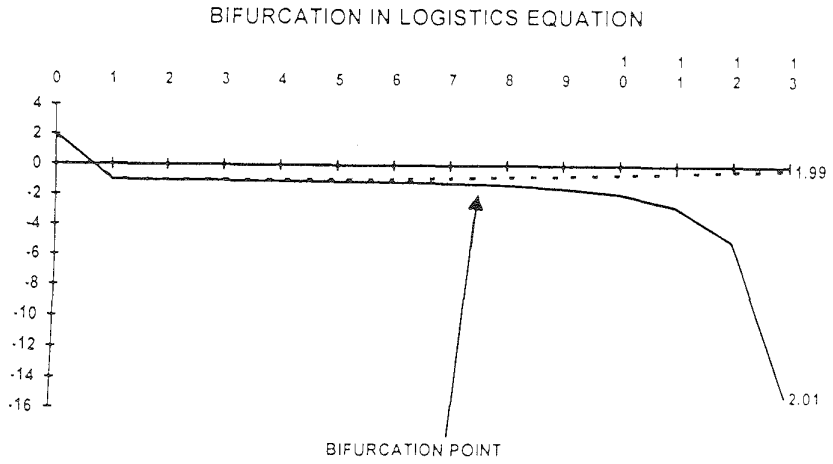
13/08:09:46 F-SEP/DEC S&P LAST = 21:15:46 434.100 434.100 434.100 434.100

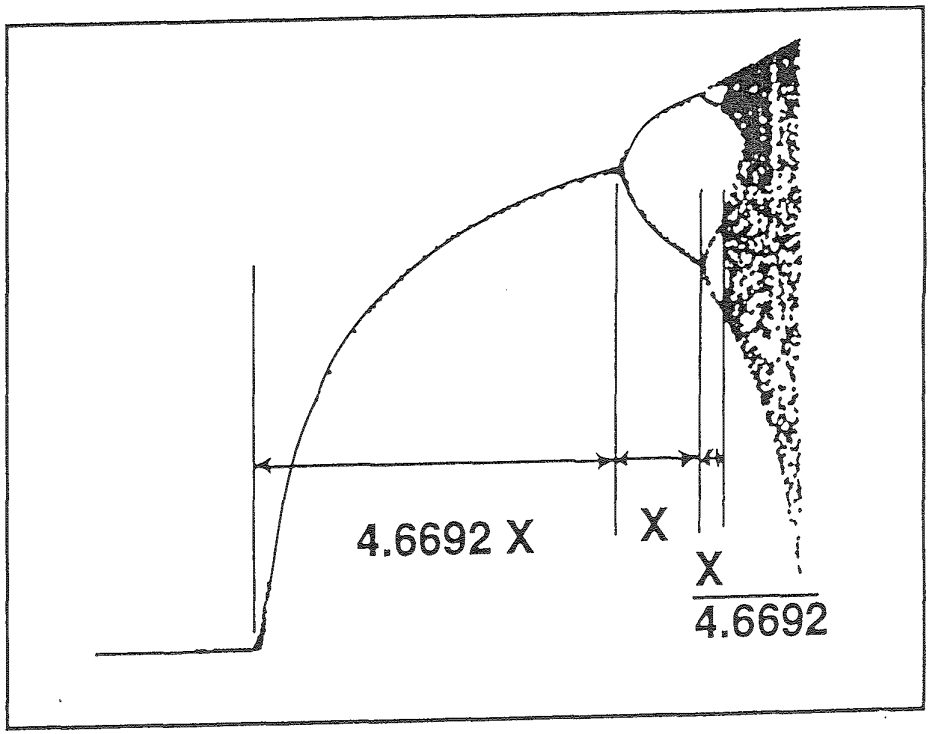

460
440
420
400
380
360
340
320
300
280
SP500
PROJECT THE END OF THIS FRACTAL
USING THE CROSS BAR
09/01/90
12/01/91
03/01/91
06/01/91
09/01/91
12/01/91
03/01/91
06/01/91
09/01/91
12/01/91
03/01/91
06/01/91
09/01/91
12/01/91
01/01/94

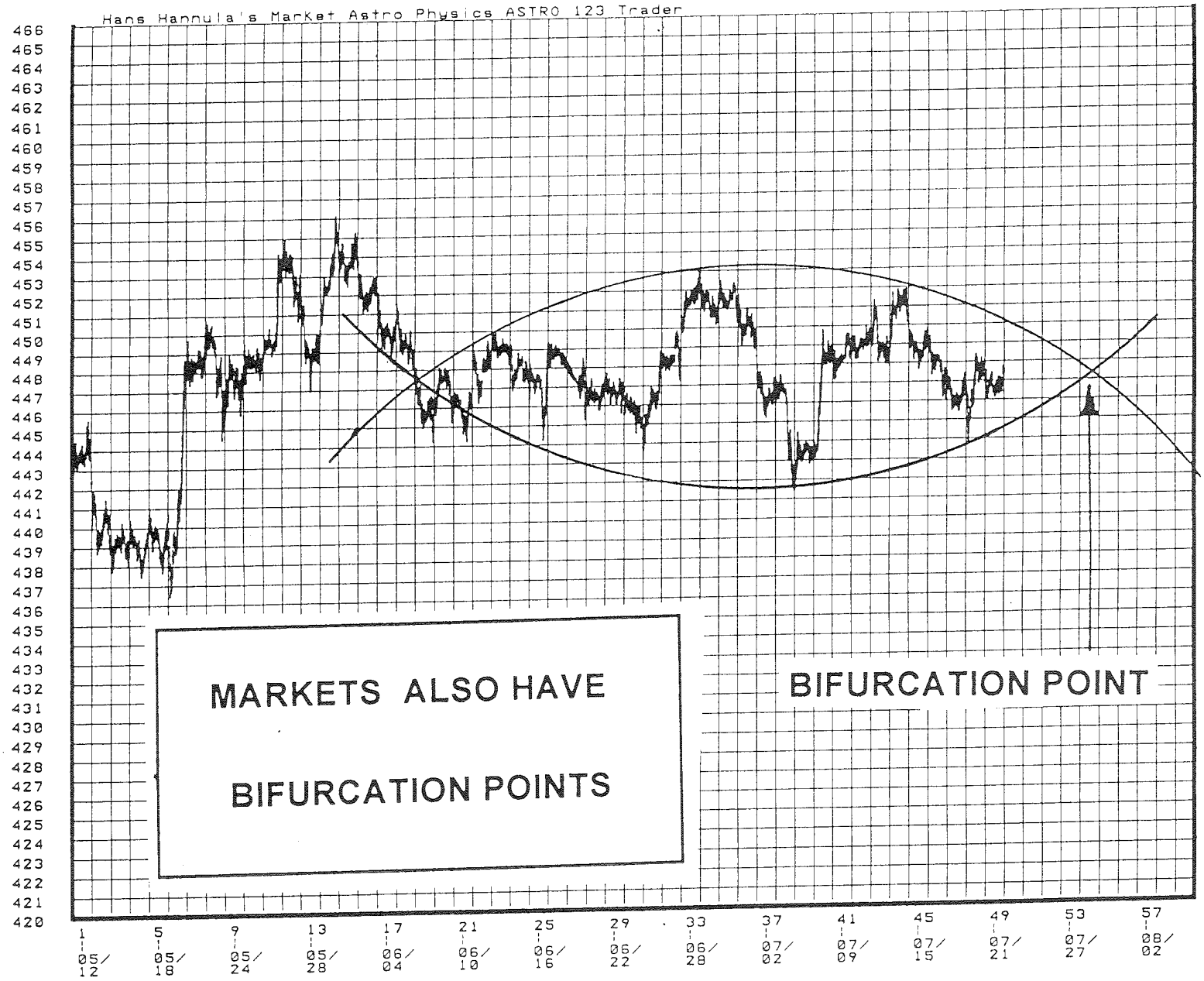
BIFURCATION AND THE FEIGENBAUM CONSTANT

1. BIFURCATION MEANS CHOOSING BETWEEN TWO PATHS
2. FEIGENBAUM SHOWED AND LANFORD PROVED THAT BIFURCATION OCCURS AT POINTS RELATED BY

4.669201609 WHICH IS A UNIVERSAL CONSTANT LIKE PI






Hans Hannula's Market Astro Physics ASTRO 123 Trader
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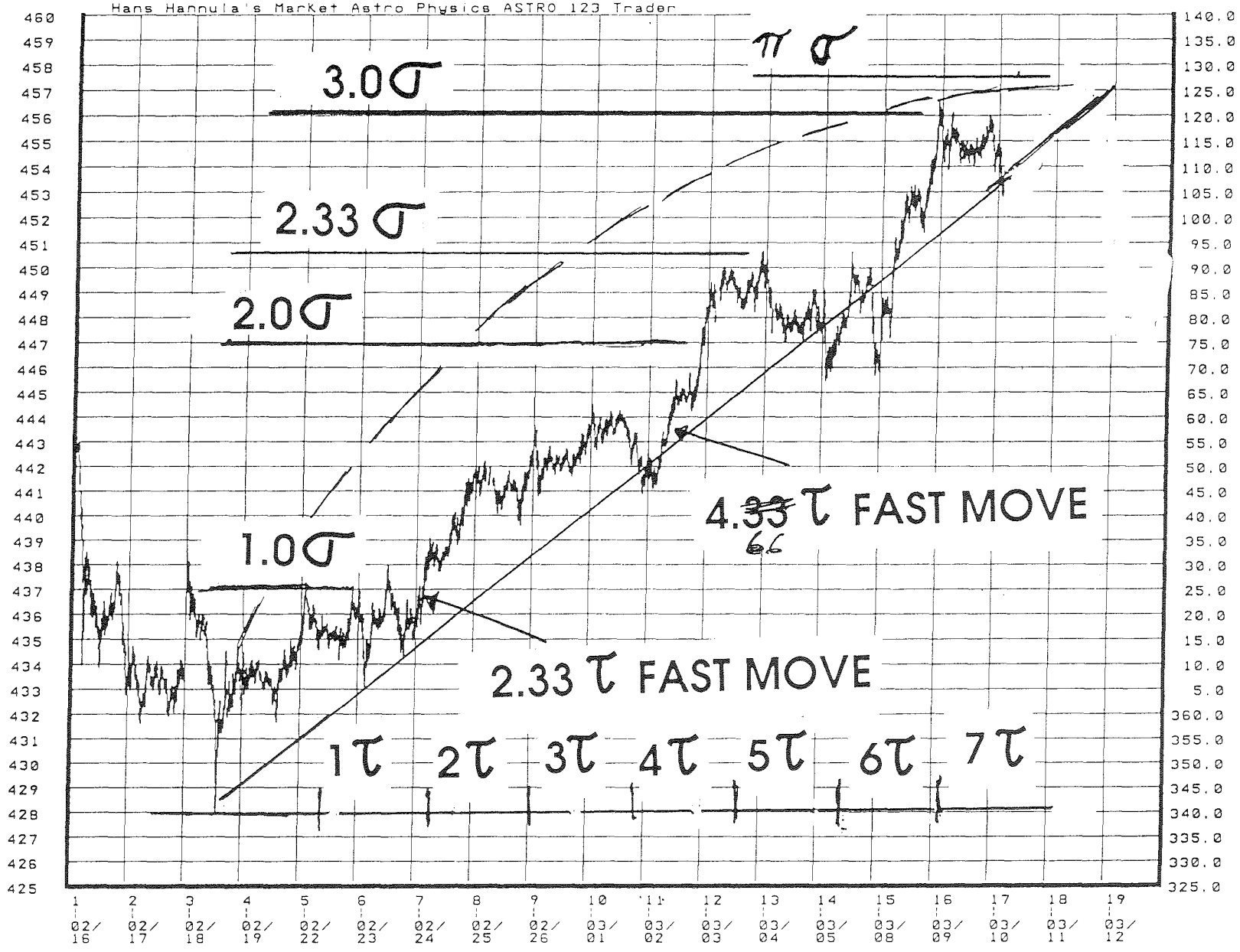
420
MARKETS ALSO HAVE
BIFURCATION POINTS
BIFURCATION POINT
1 05/12
5 05/18
9 05/24
13 05/28
17 06/04
21 06/10
25 06/16
29 06/22
33 06/28
37 07/02
41 07/09
45 07/15
49 07/21
53 07/27
57 08/02
S&P 500 NEAR


Hans Hannula's Market Astro Physics ASTRO 123 Trader
3.0σ
π σ
2.33 σ
2.0σ
1.0σ
4.33 τ FAST MOVE
66
2.33 τ FAST MOVE
1τ 2τ 3τ 4τ 5τ 6τ 7τ
460 459 458 457 456 455 454 453 452 451 450 449 448 447 446 445 444 443 442 441 440 439 438 437 436 435 434 433 432 431 430 429 428 427 426 425
140.0 135.0 130.0 125.0 120.0 115.0 110.0 105.0 100.0 95.0 90.0 85.0 80.0 75.0 70.0 65.0 60.0 55.0 50.0 45.0 40.0 35.0 30.0 25.0 20.0 15.0 10.0 5.0 360.0 355.0 350.0 345.0 340.0 335.0 330.0 325.0
1 02/16
2 02/17
3 02/18
4 02/19
5 02/22
6 02/23
7 02/24
8 02/25
9 02/26
10 03/01
11 03/02
12 03/03
13 03/04
14 03/05
15 03/08
16 03/09
17 03/10
18 03/11
19 03/12
S&P 500 NEAR
DOTODAY1

USING THE STOP AND REVERSE (SAR)

1. RECOGNIZES WIDE TAILS OF PARETIAN STATISTICS
2. WILL ALWAYS HAVE YOU IN THE BIG MOVES
3. SAVES ALL REGRETS

TO COMPUTE:

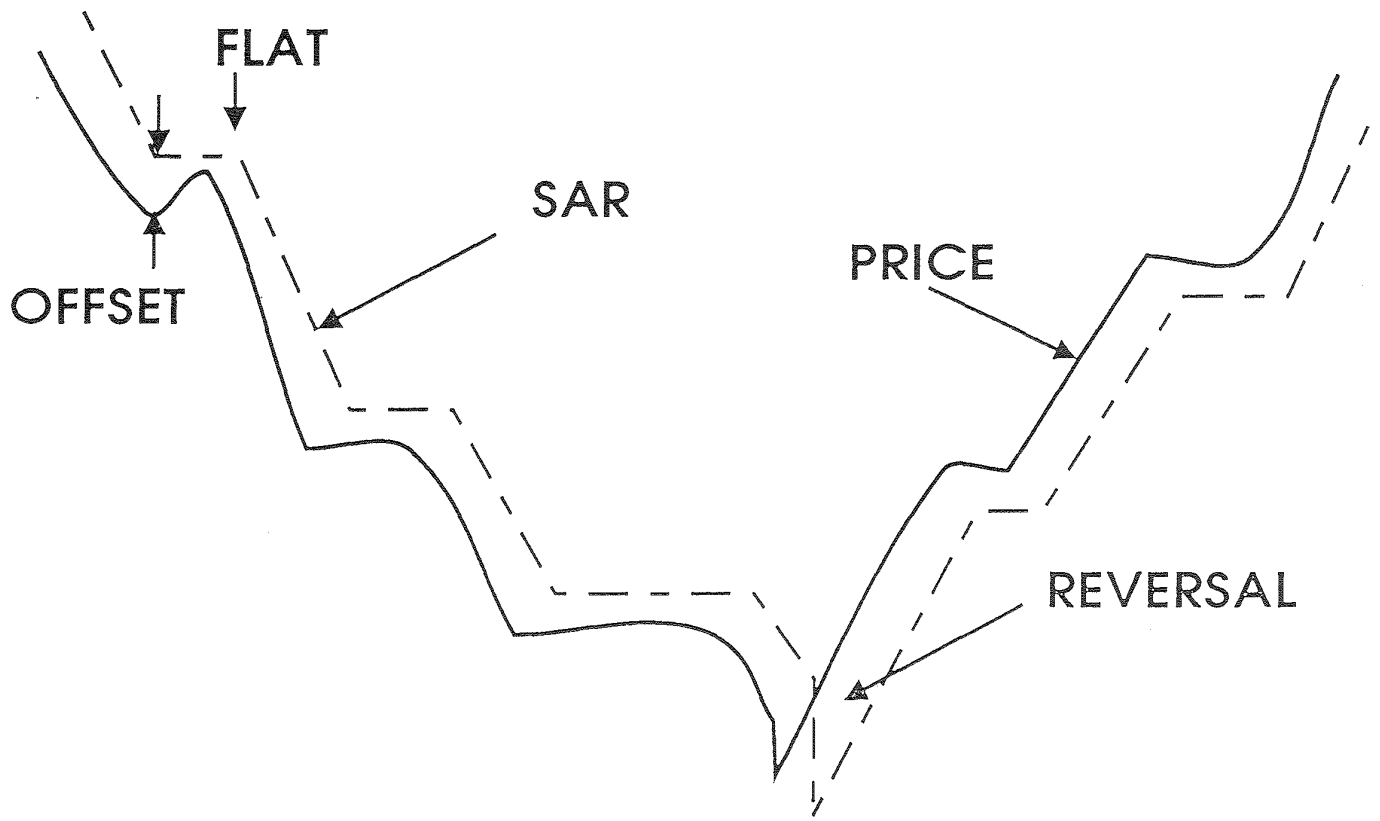
1. USE C LOSING PRICES (5 minute for daytrading)
2. TO BEGIN:
   IF TREND IS DOWN
      SAR = LAST CLOSE + OFFSET (OFFSET=.8 FOR S&P DAYTRADE)
   IF UP
      SAR = LAST CLOSE - OFFSET
3. FOLLOWING STEPS:

IF DOWN,
 AND LAST CLOSE IS MORE THAN OFFSET BELOW THE SAR,
    NEW SAR = LAST CLOSE + OFFSET

IF UP,
 AND MOST LAST CLOSE IS HIGHER THAN OFFSET ABOVE THE SAR,
    NEW SAR = LAST CLOSE - OFFSET

4. IF LAST CLOSE CROSSES SAR, REVERSE THE TRADE AND START OVER AT STEP 3.

THE STOP AND REVERSE LINE



1. EASILY ADDED TO MANY ONLINE SOFTWARE SYSTEMS
2. CHOICE OF OFFSET DETERMINES PROFIT
   - -CHOPS WHEN RANGE IS LESS THAN 2 X OFFSET
   - -IF CHOP, IN TRADING RANGE, USE VOL. B. O.

Sources of Market Chaos

WHAT IS MARKET ASTROPHYSICS?

Market AstroPhysics is the study of the Solar Energy System and its effect on markets.

WHAT ARE THE PARTS OF THE SYSTEM?

sun
9 planets
moon
solar wind
electromagnetic field
humans
markets

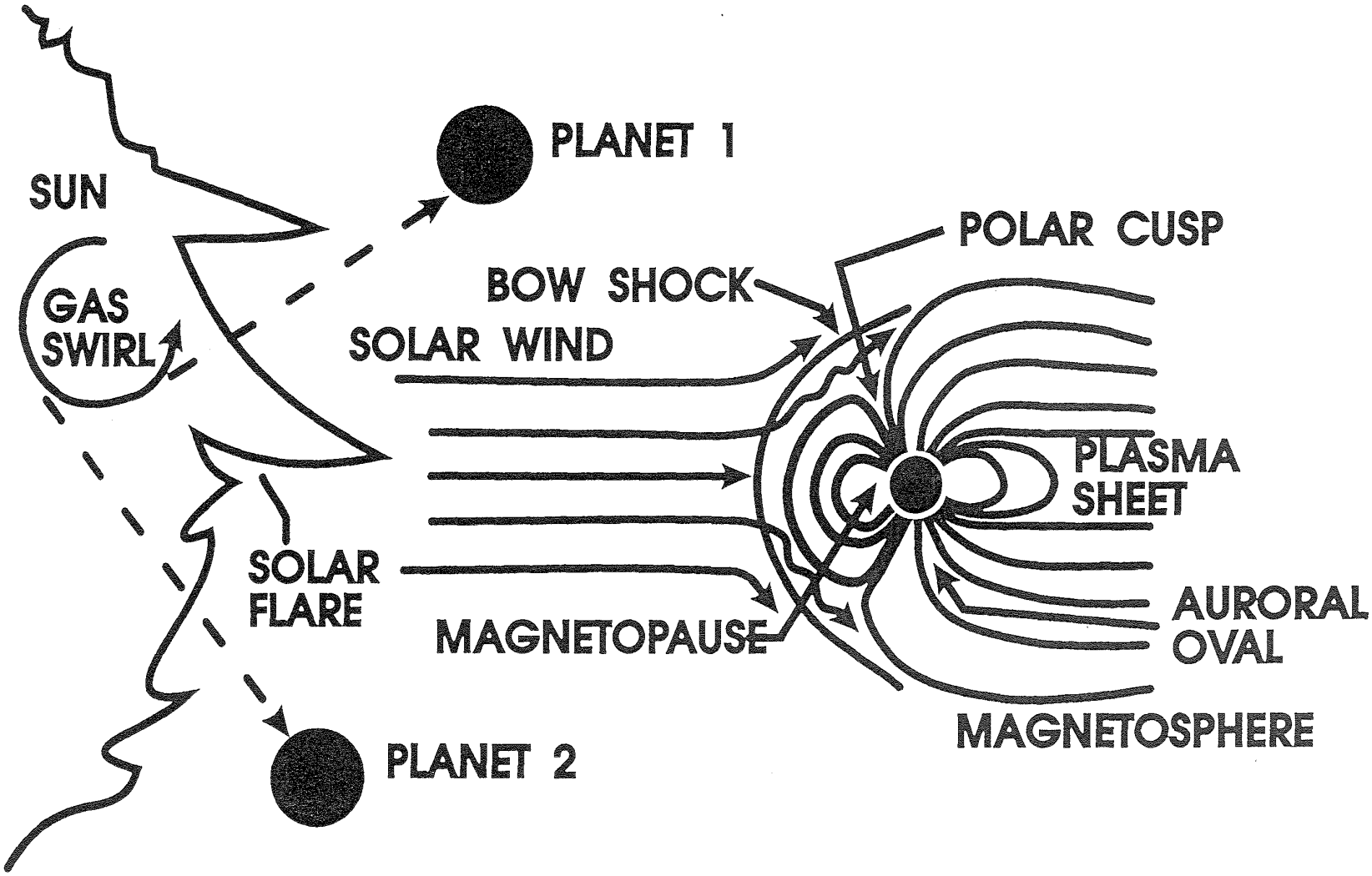


Figure 1. SOLAR STIRRING FORCE

MARKET ASTROPHYSICS METHODOLOGY

1. DEVELOPE PHYSICAL THEORY
2. DEVELOP MATHMATICAL MODEL
3. COMPUTE TIME SERIES
4. TEST CORRELATION
5. IF GOOD, ADD TO TOOLKIT
6. TEST BY USE IN MARKET

SOURCES OF MARKET CHAOS

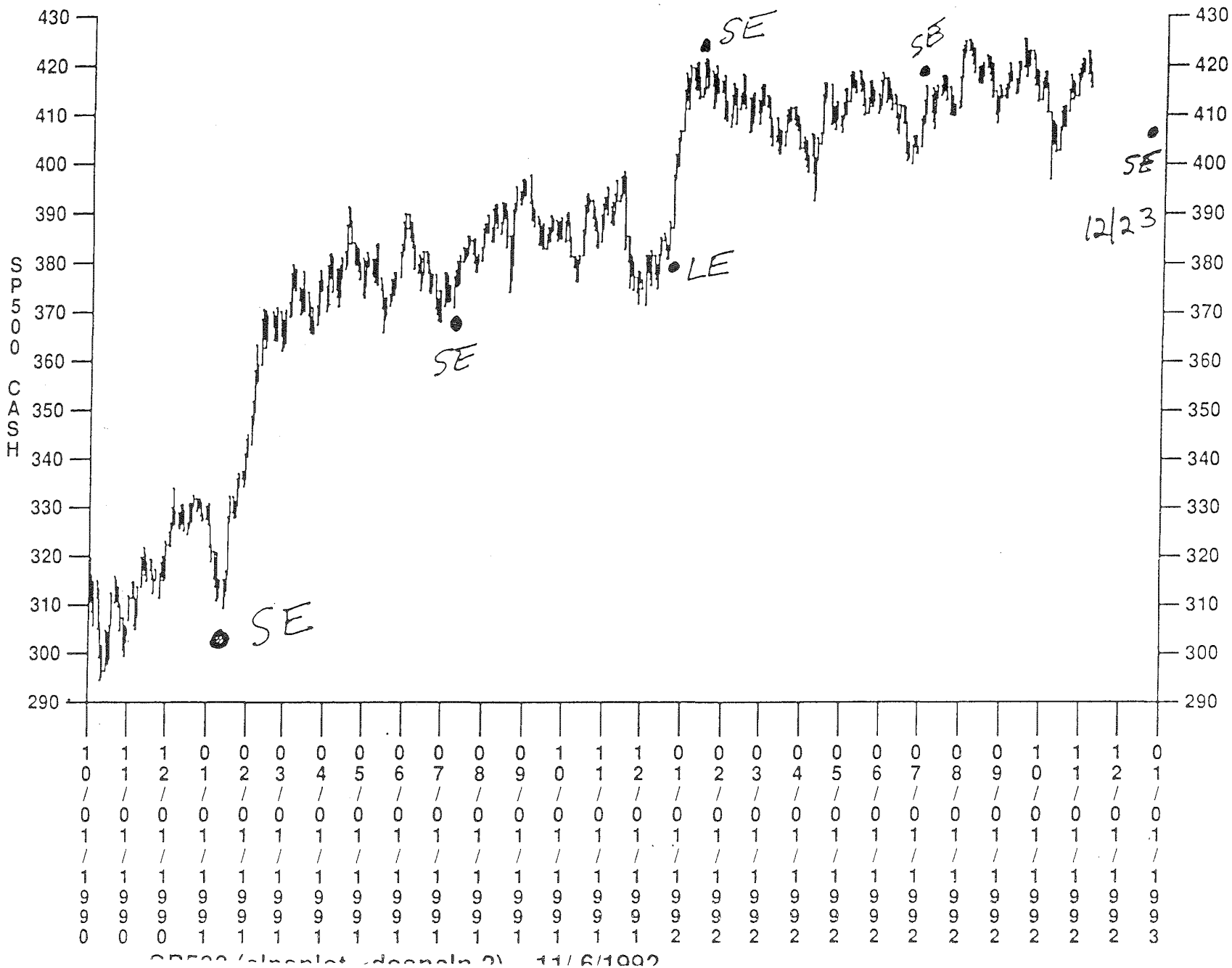
Anything that interupts the energy flow

- solar and lunar eclipses
- planetary eclipses
- lunar chaos events
- market hours

Harmonic Energy Addition

- addition of linear and nonlinear cycles
- jump resonance events

Movement of the Center of Solar System Mass


SP500 CASH
430
420
410
400
390
380
370
360
350
340
330
320
310
300
290
SE
SE
LE
SB
SE
12/23
10/01/1990
11/01/1990
12/01/1990
01/02/1991
02/01/1991
03/01/1991
04/01/1991
05/01/1991
06/01/1991
07/01/1991
08/01/1991
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10/01/1991
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01/02/1992
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04/01/1992
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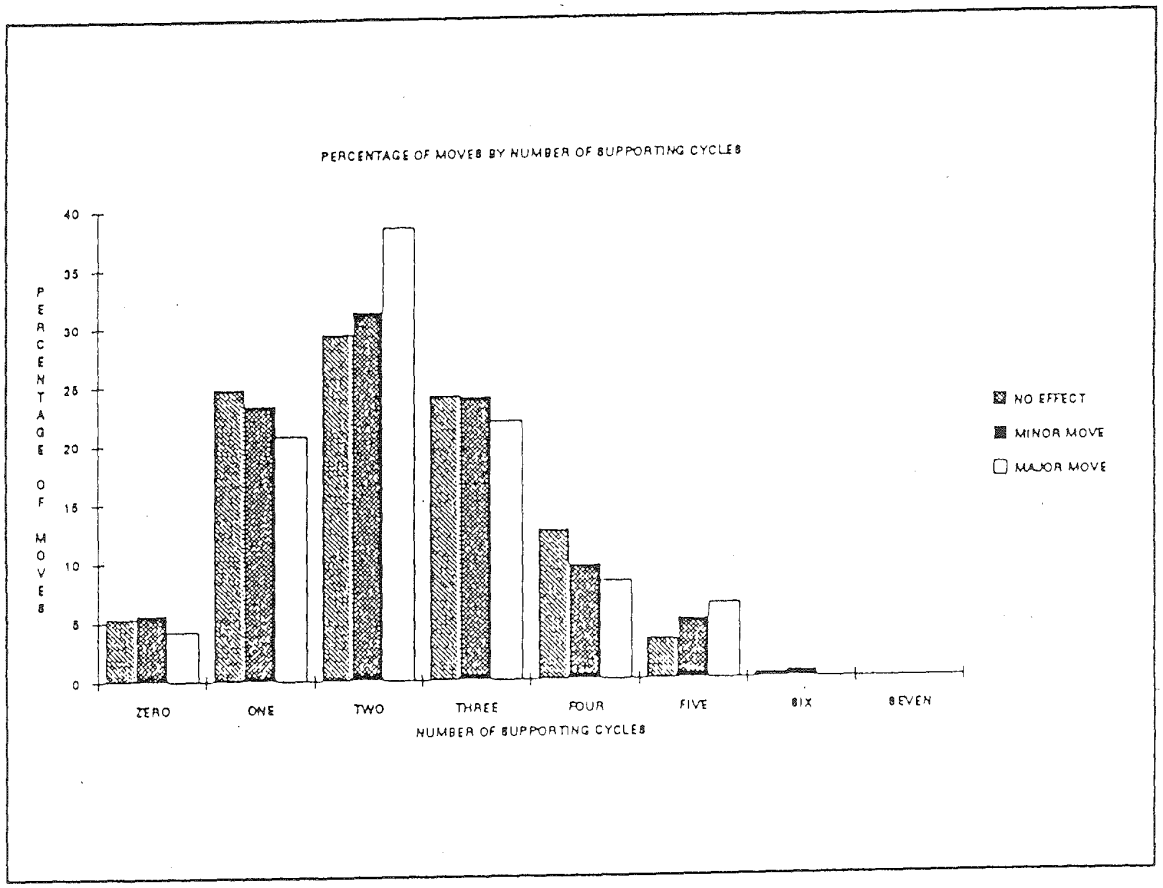
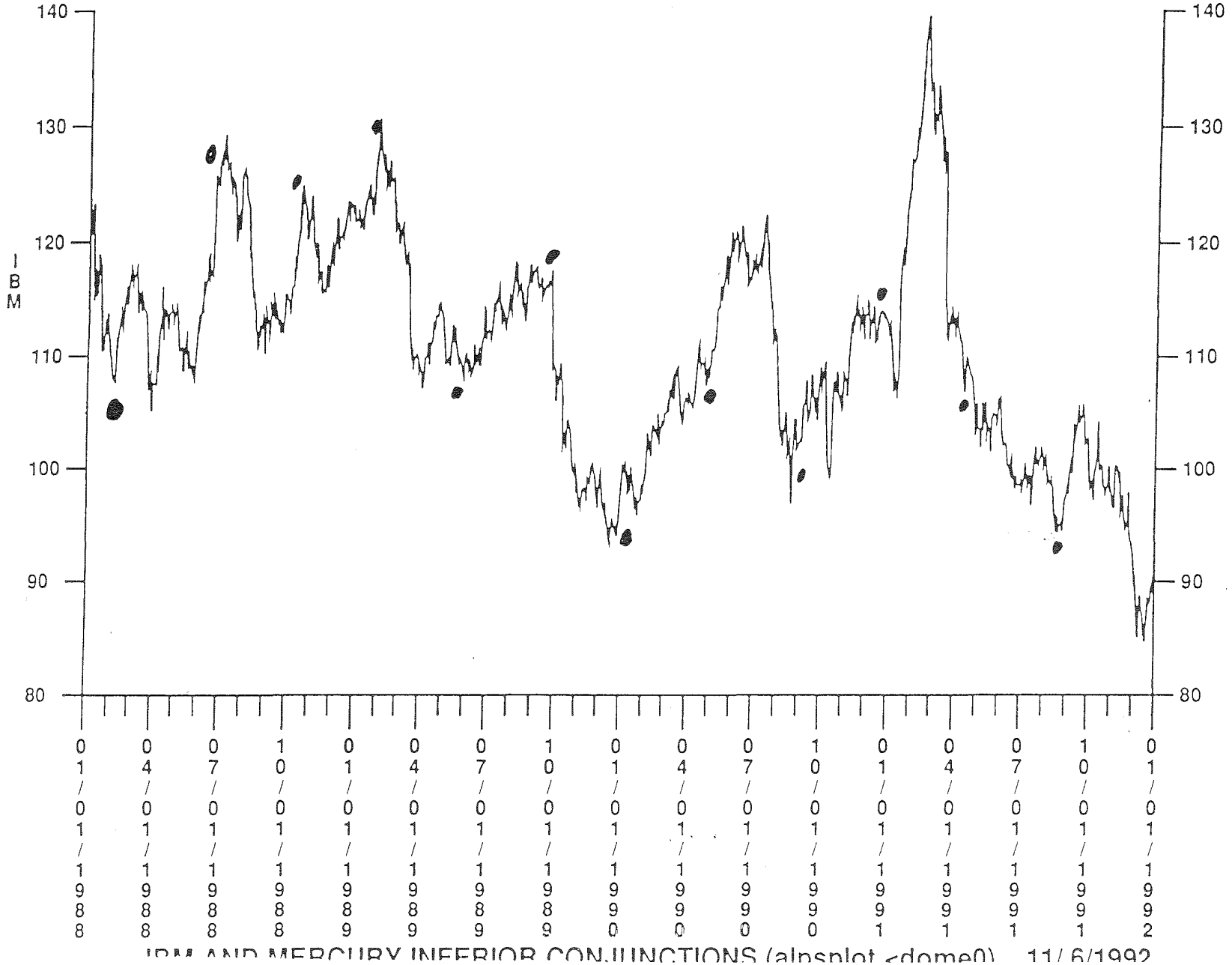
11/01/1992
12/01/1992
01/01/1993
11/6/1992



one chart from "Trading the Eclipses"


140
130
120
110
100
90
80
IBM
01/01/1988
04/01/1988
07/01/1988
10/01/1988
01/01/1989
04/01/1989
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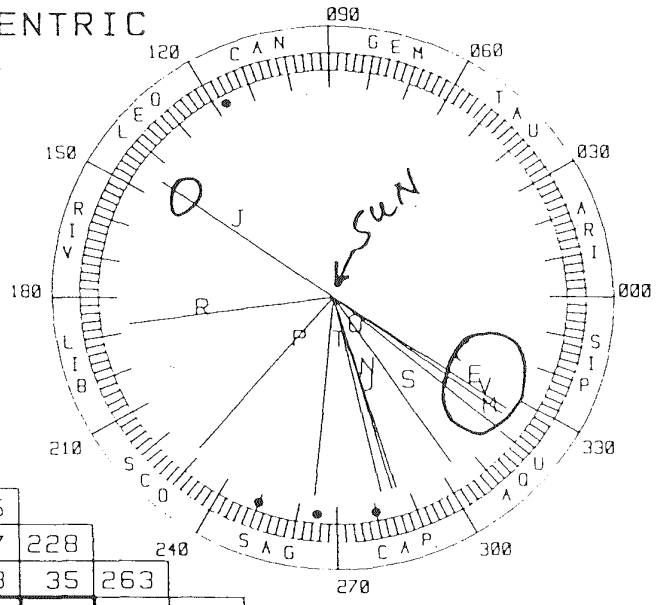
10/01/1990
01/01/1991
04/01/1991
07/01/1991
10/01/1991
01/01/1992
IBM AND MERCURY INFERIOR CONJUNCTIONS (alpsplot <dome0) 11/ 6/1992

MARKET ASTROPHYSICS EPHEMERIS

HELIOCENTRIC

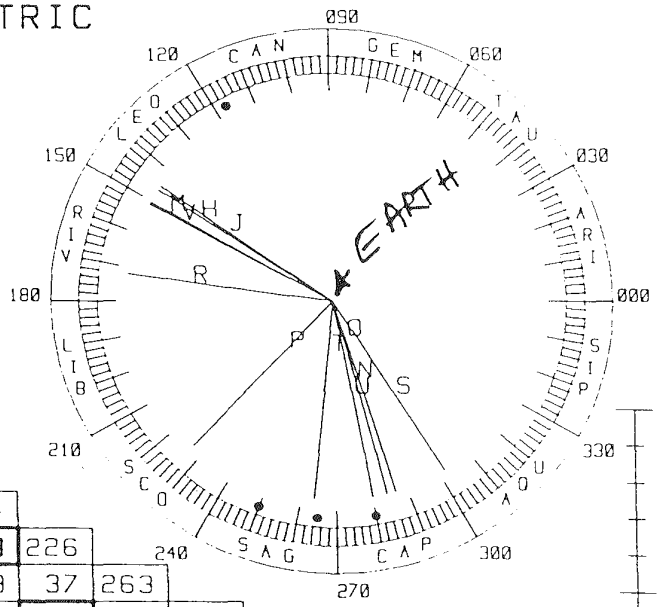
8 19 1991 17:00 UT

2448488.208 JED



	M	V	E	R	J	S	U	N	P	T	O	A	B	C	D
M	320														
V	356	324													
E	354	**358**	326												
R	**133**	**137**	139	187											
J	176	**180**	**182**	**43**	144										
S	16	20	22	243	201	304									
U	38	42	**44**	265	**222**	22	282								
N	35	39	41	262	219	18	357	285							
P	**92**	96	97	319	276	75	54	57	228						
T	304	**299**	**298**	76	**119**	320	341	338	35	263					
O	33	37	39	261	**218**	343	5	**1**	**58**	337	286				
A	**70**	**74**	76	**298**	255	306	**328**	324	21	14	37	250			
B	55	**59**	**61**	283	**240**	321	343	339	36	**359**	22	345	265		
C	40	**44**	**46**	**268**	**225**	336	**358**	354	51	344	7	**330**	345	280	
D	203	**207**	**209**	**71**	**28**	173	195	191	248	**147**	170	**133**	148	163	117

GEOCENTRIC



	M	V	H	R	J	S	U	N	P	T	O	A	B	C	D
M	150														
V	**359**	151													
H	4	5	146												
R	338	339	334	171											
J	5	6	**1**	**27**	144										
S	**208**	**209**	204	230	203	301									
U	230	231	**226**	252	**225**	21	280								
N	**226**	**227**	**222**	248	221	17	356	284							
P	283	284	279	305	278	75	53	**58**	226						
T	114	113	**118**	**92**	**119**	322	344	339	37	263					
O	**223**	**224**	219	245	**218**	345	7	3	**60**	337	286				
A	260	261	256	282	255	308	**330**	326	23	14	37	250			
B	245	246	**241**	**267**	**240**	323	345	341	38	**359**	22	345	265		
C	230	231	**226**	252	**225**	338	**360**	356	53	344	7	**330**	345	280	
D	33	34	**29**	55	**28**	175	197	193	250	147	170	**133**	148	163	117

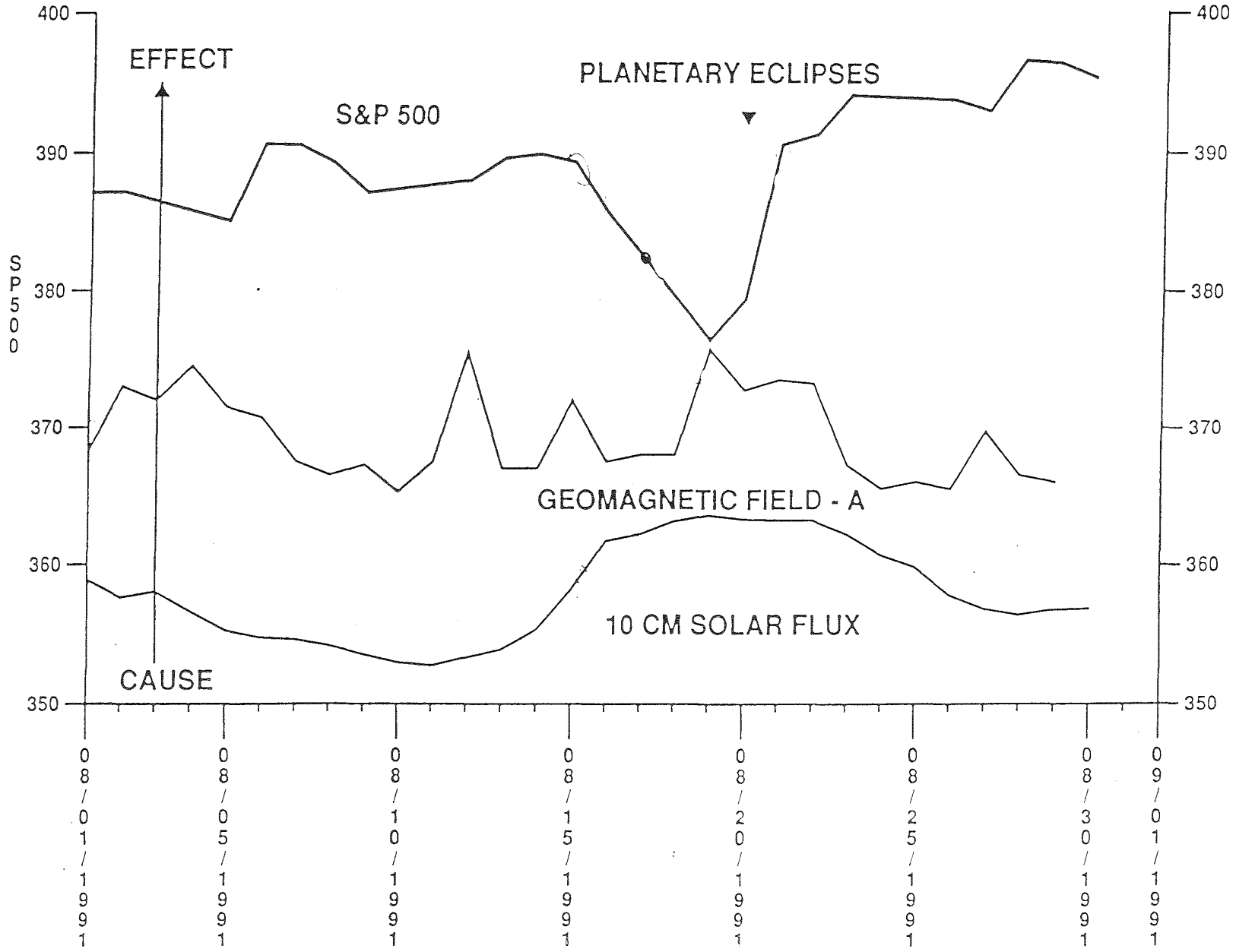


FIGURE 4. ASTROPHYSICS OF THE DOUBLE PLANETARY ECLIPSE 10/22/1991

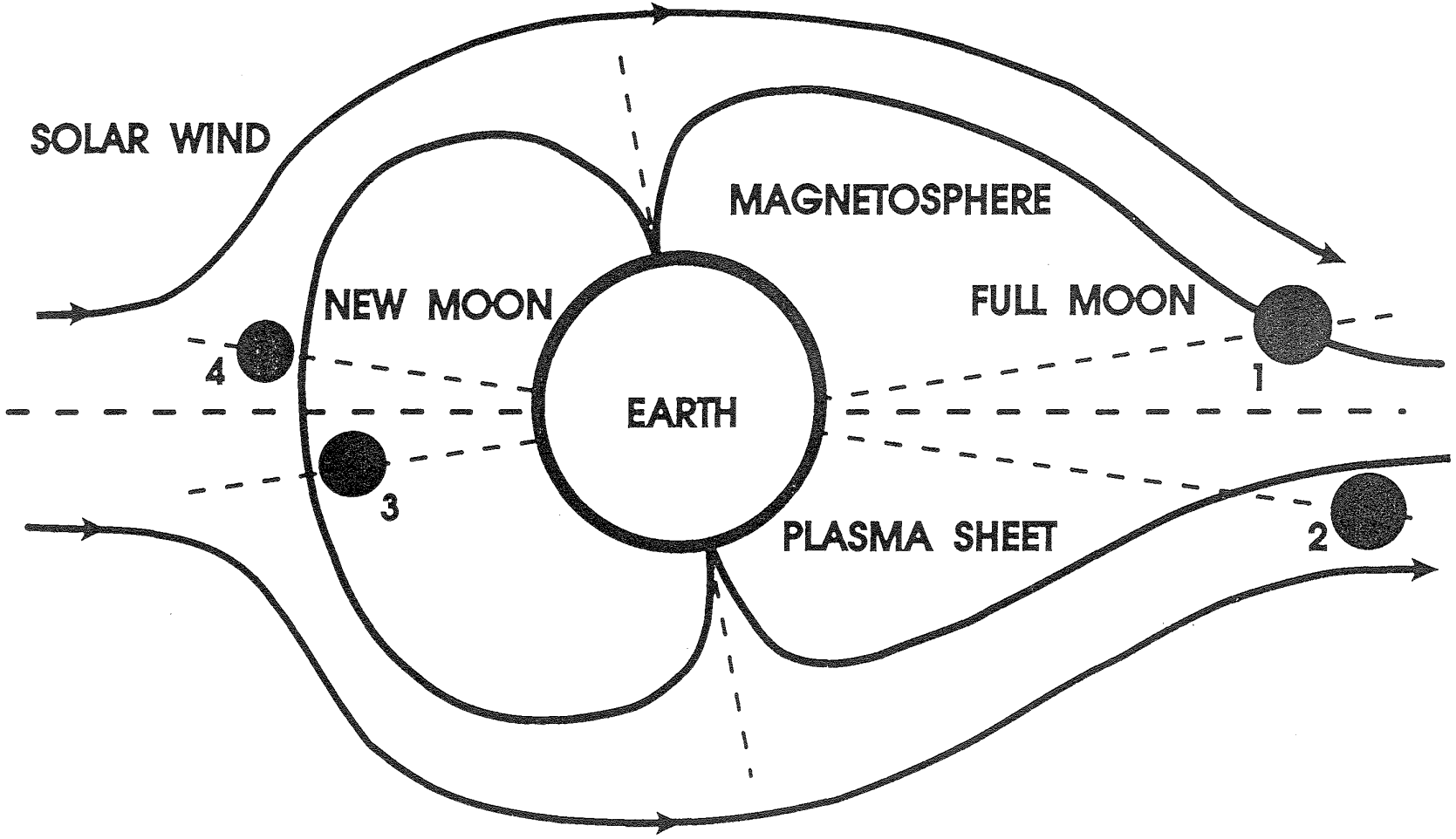


Figure 2. LUNAR CHAOTIC BOUNDARIES

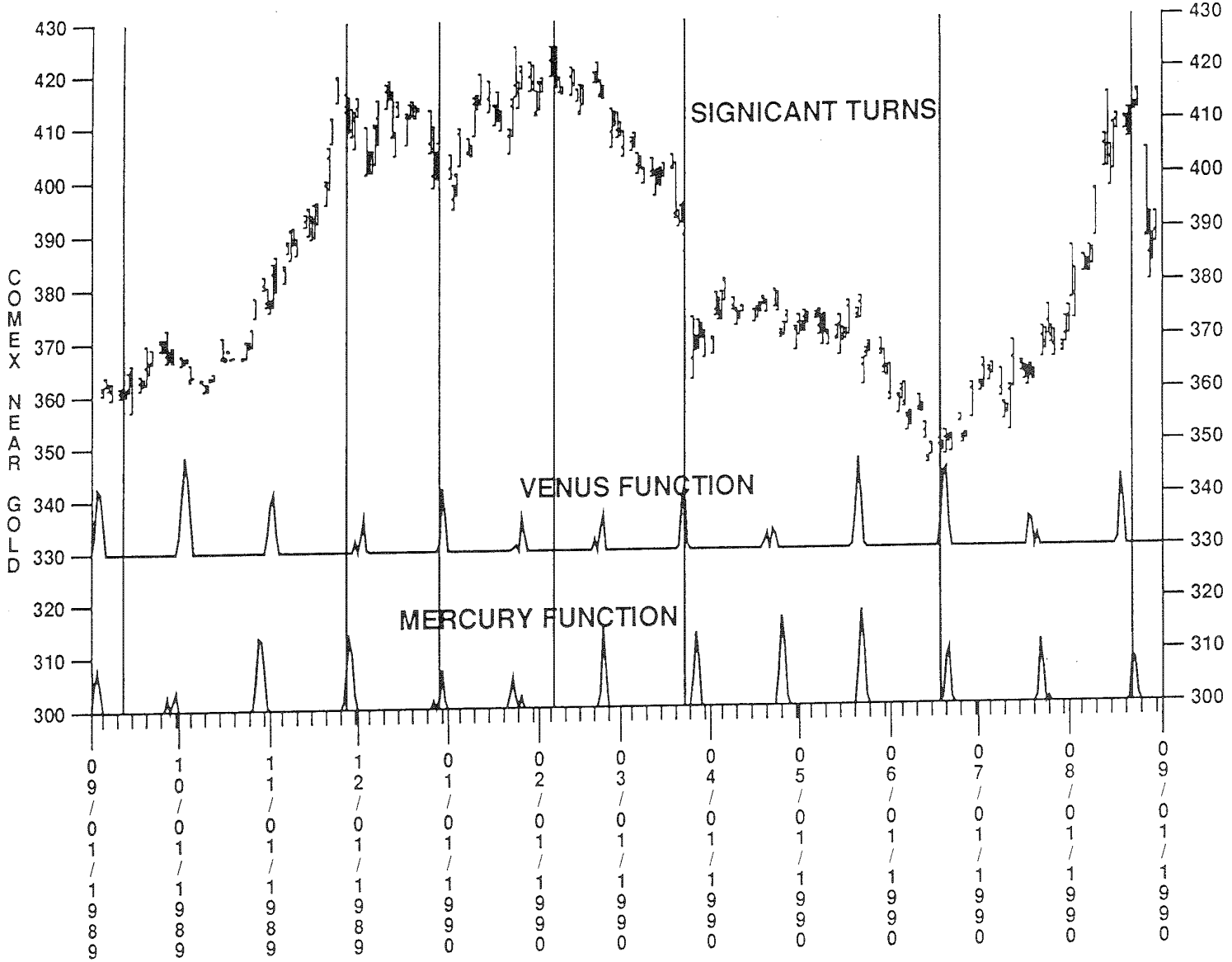


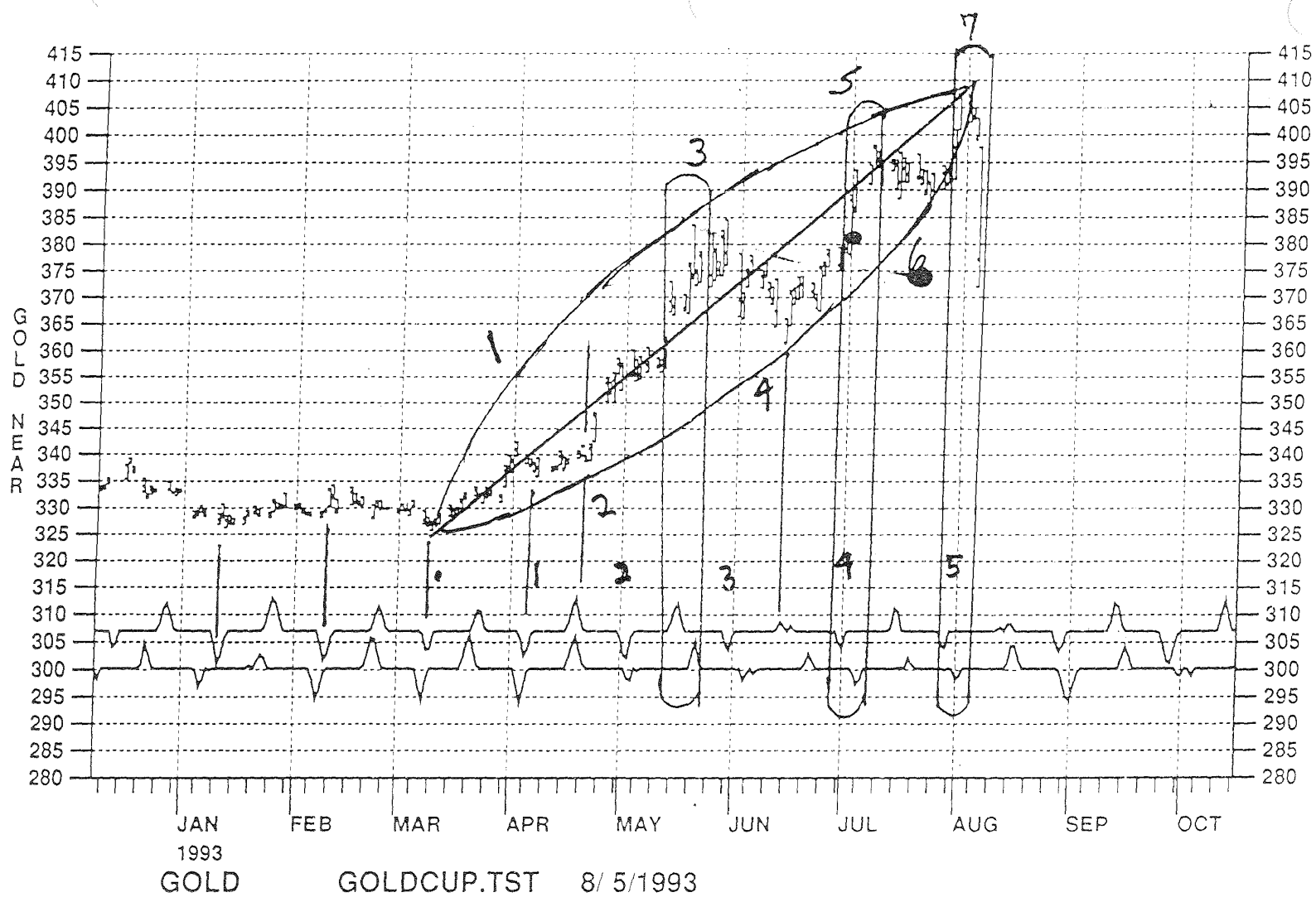
Figure 5. GOLD AND THE TWO LUNAR CHAOS FUNCTIONS

	NUMBER OF CHAOS EVENTS	NUMBER TURNS HITTING WINDOWS	PROBABILITY OF BEING RANDOM	ODDS AGAINST BEING RANDOM
VENUS	121	41	.00138	724:1
MERCURY	121	40	.00254	393:1
BOTH	88	31	.00350	285:1

NOTE: NUMBER OF TURNS IN GOLD = 85

WINDOW = 10 DAYS, INTERVAL = 3652 DAYS

Table 1. Gold Chaos Statistics


GOLD NEAR
415
410
405
400
395
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375
370
365
360
355
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345
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330
325
320
315
310
305
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285
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JAN
1993
FEB
MAR
APR
MAY
JUN
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SEP
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1
2
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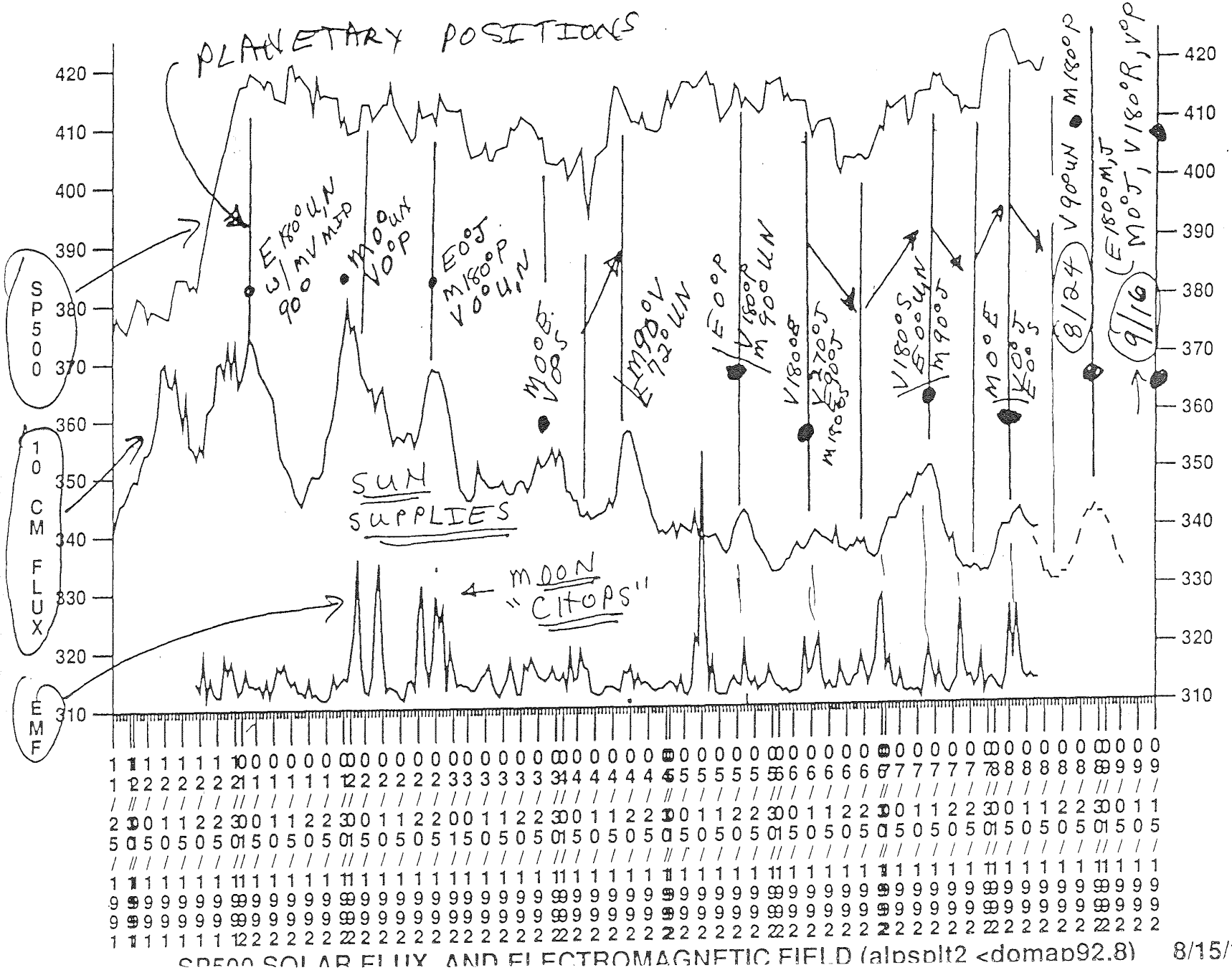
GOLD GOLDCUP.TST 8/ 5/1993



SP500 SOLAR FLUX AND ELECTROMAGNETIC FIELD (alpsplt2 <domap92.8) 8/15/1992

Conclusion

SOURCES OF MORE INFORMATION

Books

1. Chaos, The Making of a New Science, Gliek
2. Chaos and Order in the Capital Markets, Edgar Peters
3. The Fractal Geometry of Nature, Mandelbrot
4. A First Course in Chaotic Dynamical Systems, Devaney

Articles

Hannula, Landscheidt

YOU CAN CASH IN ON CHAOS

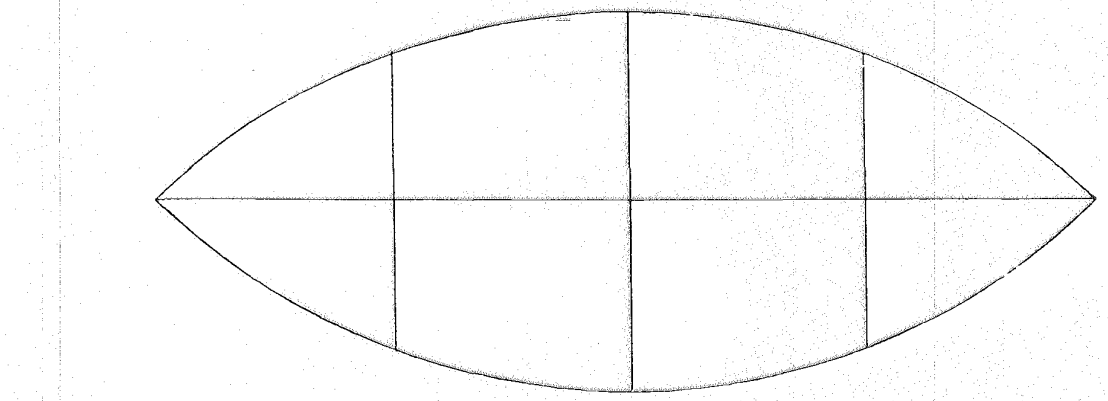
1. ALL MARKETS ARE NON-LINEAR DYNAMICAL SYSTEMS

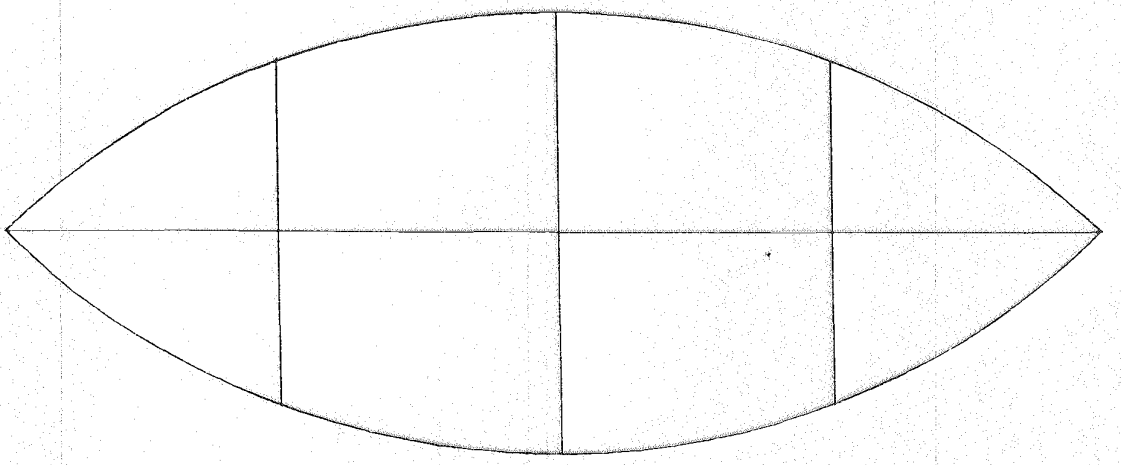
2. THESE SYSTEMS EXHIBIT PERIODS OF NEARLY PREDICTABLE BEHAVIOR, INTERSPERSED WITH EPISODES OF CHAOTIC BEHAVIOR

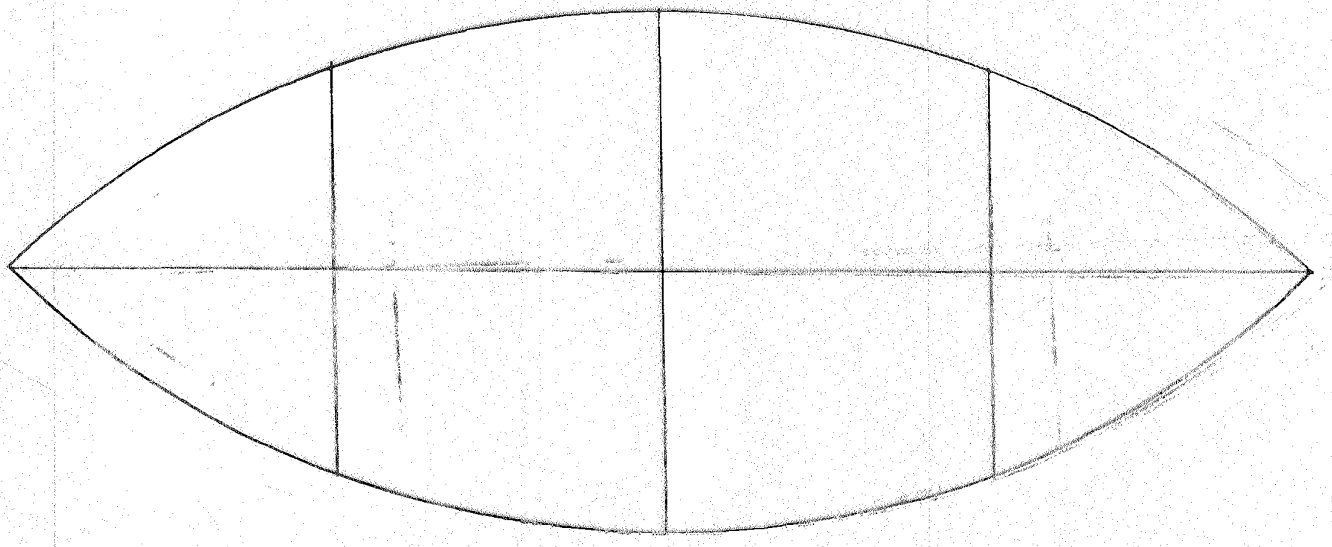
3. EVERY MOVE IN EVERY MARKET ON ANY SCALE FORMS A HANNULA MARKET FRACTAL

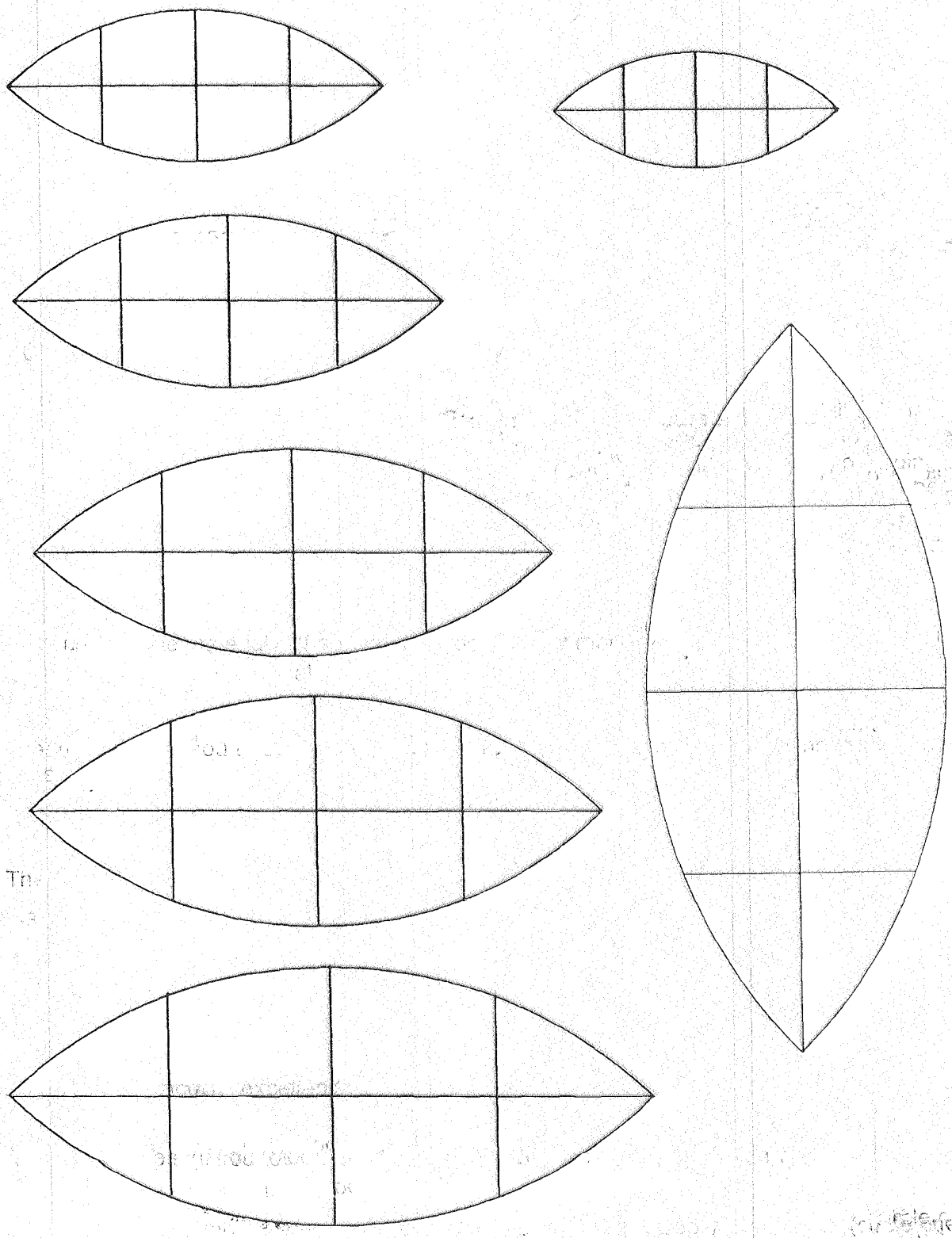
4. THE HANNULA MARKET FRACTAL CAN BE PROJECTED TO REASONABLY PREDICT FUTURE BEHAVIOR

5. THE HANNULA MARKET FRACTAL CAN BE TRADED SUCCESSFULLY









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These tapes also have a uniquely recorded serial number, enabling any copies to be traced to the original purchaser.

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Dr. Hans Hannula